# نهمین سمینار سالانه الکتروشیمی ایران

## ۱۳و۱۴ آذر ماه ۱۳۹۲

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محورهای همایش

- سنتز الکتروشیمیایی و مهندسی الکتروشیمی فولن ها، نانولوله ها، و کربن نانو ساختاری
- الکتروشیمی (شیمی فیزیکی و تجزیه ای)
- حسگرها و صفحه نمایش (اصول، مواد و فرایند ها)

محورهای همایش

- باتری ها، پیل سوختی ها و تغییرات انرژی
- خوردگی، غیرفعال سازی، غشاهای آندی
- مواد عایق و نیمه هادی، دستگاه ها و فرایندها
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بسم الله الرحمن الرحيم

# Table of Content

# برنامه زمان بندی نهمین همایش سالانه الکتروشیمی ایران

# دانشگاه تربیت مدرس-سالن(۱)جابربن حیان

# چهارشنبه ۱۳ آذر ماه ۱۳۹۲

| جلسه افتتاحیه همایش | | |
|---|---|---|
| ردیف | موضوع | زمان |
| ۱ | پذیرش و ثبت نام | ۷:۳۰-۸:۳۰ |
| ۲ | تلاوت آیاتی از قران مجید | ۸:۳۰-۸:۳۵ |
| ۳ | سرود جمهوری اسلامی ایران | ۸:۳۵-۸:۴۰ |
| ۴ | خیرمقدم و اعلام برنامه (مجری) | ۸:۴۰-۸:۵۰ |
| ۵ | گزارش دبیر همایش- جناب آقای دکتر حسین غریبی | ۸:۵۰-۹:۰۰ |
| ۶ | سخنرانی مشاور وزیر علوم- جناب آقای دکتر توفیقی | ۹:۰۰-۹:۲۰ |
| ۷ | سخنرانی مدیر کارگروه توسعه منابع انساني ستاد نانو- جناب آقای دکتر رضایت | ۹:۲۰-۹:۴۰ |
| ۸ | مراسم تقدیر ازبزرگان علم الکتروشیمی ایران | ۹:۴۰-۱۰:۰۰ |
| ۹ | پذیرایی و بازدید از پوسترها | ۱۰:۰۰-۱۰:۴۰ |

| سالن شماره(۱) جابربن حیان | | |
|---|---|---|
| **چهارشنبه ۱۳۹۲/۹/۱۳**<br>**ارائه مقالات همایش** | | |
| **ردیف** | **موضوع: باتری ها ، پیل سوختی و تغییر انرژی** | **زمان** |
| **هیات رئیسه: آقای دکتر مجید جعفریان و آقای دکتر وفایی** | | |
| ۱ | *Invited speaker*<br>عنوان سخنرانی:<br>Metal-Organic Frameworks; New Highly Porous Materials for Hydrogen Storage<br>دکتر علی مرسلی | ۱۰:۴۰-۱۱:۱۰ |
| ۲ | سخنرانی علمی کد ۳۴۱با عنوان:<br>Facile Enter-Step Strategy to Produce Platinum/Nitrogen Doped Graphene as high Performance Electrocatalyst for Direct oxygen Reduction and Anodic Fuel oxidation<br>Aso Navaee[a], Abdollah Salimi[a,b] | ۱۱:۱۰-۱۱:۳۰ |
| ۳ | سخنرانی علمی کد 197 با عنوان:<br>Synthesis of Hard Carbon as Anode Material for Lithium-Ion Battery<br>M. Khosravi[1], N. Bashirpour[1] , F.Nematpour[1] | ۱۱:۳۰-۱۱:۵۰ |
| ۴ | سخنرانی علمی کد 487 با عنوان:<br>Evaluation of Non-Pt Cathode Catalyst in Alkaline Direct Borohydride Fuel Cell<br>I. Mohammadi[1], S. Majidi[2], M. Zhiani[3], M. M. Taghiabadi[4] | ۱۱:۵۰-۱۲:۱۰ |
| ۵ | سخنرانی علمی کد 379با عنوان:<br>Synthesis the Core-Shell Structure of Electrocatalyst and Investigation the performance of these for ORR in PEMFC<br>M.Javaheri | ۱۲:۱۰-۱۲:۳۰ |

| | | |
|---|---|---|
| ۶ | نهار ونماز | ۱۲:۳۰-:۱۴ |
| **موضوع: باتری ها ، پیل سوختی** | | |
| **هیات رئیسه: دکتر احسانی و دکتر میرزایی** | | |
| ۷ | کد ۴۹۴<br>Effect of Dispersion Solvent in Catalyst Ink on Proton Exchange Membrane Fuel Cell Performance<br>Maryam Aghili Nategh[1], Hussein Gharibi[1] | ۱۴:۰۰-۱۴:۲۰ |
| ۸ | سخنرانی علمی کد ۴۰۷با عنوان:<br>Fabrication of High Performance Bioanode based on Fruitful Association of Dendrimer and Carbon nanotube used for design O2/Glucose Membrane-less Biofuelcell with Improved Bilirubine Oxidase Biocathode<br>Aazam Korani[a],, AbdollahSalimi[a,b] | ۱۴:۲۰-۱۴:۴۰ |
| ۹ | سخنرانی علمی کد۲۵۵با عنوان:<br>Study of Composite Formation on Oxygen Reduction Reaction in Zinc-air Semi-Fuel Cell<br>Nasrin farshadi[1] , Rasol Abdullah Mirzaie[1] ,Mohammad safi Rahmanifar[*2] | ۱۴:۴۰-۱۵:۰۰ |
| ۱۰ | سخنرانی علمی کد 310 با عنوان:<br>Synthesis and Characterization of Pd and PdCo alloy nanocatalysts as an Alchol tolerant for Oxygen Reduction Reaction<br>F.Golmohammadi[1], H.Gharibi[2] and M.Kheirmand[3] | ۱۵:۰۰-۱۵:۲۰ |
| ۱۱ | پذیرایی و بازدید از پوسترها | ۱۵:۲۰-۱۶:۰۰ |
| **موضوع: الکتروشیمی فیزیکی و تجزیه ای** | | |
| **هیات رئیسه: آقایان دکتر عسگری و دکتر غریبی** | | |
| ۱۲ | سخنرانی علمی کد 326 با عنوان:<br>Sensitization of Photoelectrochemical Solar Cells with a Natural Dye Extracted from | ۱۶:۰۰-۱۶:۲۰ |

| | | |
|---|---|---|
| | Juglans<br><br>Regia and Chamomile<br><br>R. Hemmatzadeh[1], A. Jamali[2], and A. Mohammadi[3] | |
| ۱۶:۲۰–۱۶:۴۰ | سخنرانی علمی کد 176 با عنوان:<br><br>Application of Anion Exchange Membrane in Electrochemical Energy Production Systems<br><br>M. Iravaninia[a], S. Rowshanzamir[*a,b] | ۱۳ |
| ۱۶:۴۰–۱۷:۰۰ | سخنرانی علمی کد 169 با عنوان:<br>Electrochemical Study of Surface Energy and Dipole Charge of Metals<br><br>, A. Heidaripour[1], M. Jafarian[2], and M.G. Mahjani[3] | ۱۴ |
| ۱۷:۰۰–۱۷:۲۰ | سخنرانی علمی کد 230 با عنوان:<br><br>Potentiometric investigation of 2,5 pyridine dicarboxylic acid-piperazine proton-transfer system and it's complexes with some metal ions<br><br>A. Farazmand[1], A. Shokrollahi*[2,3] | ۱۵ |

| سالن شماره(۲) سالن سمیناردانشکده علوم پایه | | |
|---|---|---|
| **چهارشنبه ۱۳۹۲/۹/۱۳**<br>**ارائه مقالات همایش** | | |
| **ردیف** | **موضوع: حسگرها** | **زمان** |
| **هیات رئیسه: آقایان دکتر علیزاده و دکتر رئوف** | | |
| ۱ | Invited speaker<br>*عنوان سخنرانی*<br>NANOMATERIAL FILMS BY LAYER-BY-LAYER TECHNIQUE, NEW APPROACH TO MAKE DNA BIOSENSORS<br>دکتر انصافی | ۱۰:۴۰-۱۱:۱۰ |
| ۲ | سخنرانی علمی کد 348 با عنوان:<br>Compare of bamboo-like carbon nanotube and multiwall CNTs/ Ionic-liquid as a highly sensitive nano-composite for choline biosensing<br>, A. Barkhordary[1], Sharareh Sajjadi[2], Amir Homayoun Keihan | ۱۱:۱۰-۱۱:۳۰ |
| ۳ | سخنرانی علمی کد ۳۵۶با عنوان:<br>Au /PAMAM-Dendrimer functionalized wired ethyleneamine-viologen as highly efficient interface for ultra-sensitive AFP electrochemical immunosensor<br>B.kavosi[1],R.Hallaj[2] , A.Salimi[3] | ۱۱:۳۰-۱۱:۵۰ |
| ۴ | سخنرانی علمی کد۳۷۱با عنوان:<br>Developing of a highly sensitive biosensor for determination of phenolic compounds<br>J. Ghodsi[1], A.A. Rrafati[2], Y. Shoja[3] | ۱۱:۵۰-۱۲:۱۰ |
| ۵ | سخنرانی علمی کد۲۰۹با عنوان:<br>Nanostructured base electrochemical sensor for determination of isoproterenol<br>, Hadi Beitollahi[1], Somayeh Tajik[2,3], Mohammad Ali Taher[2], Ali Akbari[4] | ۱۲:۱۰-۱۲:۳۰ |

| | | |
|---|---|---|
| ۶ | نهار ونماز | ۱۲:۳۰-:۱۴ |
| **موضوع: سنتز الکتروشیمیایی و الکتروشیمی فیزیکی و تجزیه ای** | | |
| **هیات رئیسه: آقایان دکتر نعمت الهی و دکتر انصافی** | | |
| ۷ | سخنرانی علمی کد 243 با عنوان:<br>Catalytic Electrosynthesis of Nanostructured Conducting Polypyrrole on Copper Interdigital Electrodes by Passivation<br>A. Ghoorchian and N. Alizadeh* | ۱۴:۰۰-۱۴:۲۰ |
| ۸ | سخنرانی علمی کد317با عنوان:<br>Impedimetric and Stripping Voltammetric Determination of Methamphetamine at Gold Nanoparticles and Multiwalled Carbon Nanotubes Modified Screen Printed Electrode<br>Banafsheh Rafiee and Ali Reza Fakhari | ۱۴:۲۰-۱۴:۴۰ |
| ۹ | سخنرانی علمی کد 267 با عنوان:<br>Voltammetry studies and determination of Buprenorphine in urine samples by carbon paste electrode modified with sodium dodecyl sulfate<br>Mohsen Behpour*, Akram Valipour | ۱۴:۴۰-۱۵:۰۰ |
| ۱۲ | سخنرانی علمی کد 361 با عنوان:<br>Application of Modified Magnetic Nanoparticles for Selective Extraction and Determination of Europium in Agricultural Water Samples<br>S.Berijani[1], M.R. Ganjali[1] , H. Sereshti[2], P.Norouzi[1] | ۱۵:۰۰-۱۵:۲۰ |
| ۱۱ | پذیرایی و بازدید از پوسترها | ۱۵:۲۰-۱۶:۰۰ |
| **هیات رئیسه: آقایان دکتر کریمی مله و دکتر رضایی** | | |
| ۱۳ | سخنرانی علمی کد 449 با عنوان:<br>Evaluationof Inhibitory Effect of Composition of Tannic acid and Phosphoric acid on Ancient Iron Object Based on electrochemical method<br>M. baqherpor[1] , s.majzoobhosseini[2] | ۱۶:۰۰-۱۶:۲۰ |

| | | |
|---|---|---|
| ۱۴ | سخنرانی علمی کد 393 با عنوان:<br><br>Glassy carbon electrode modified with graphene oxide nano-sheets and nano-structured FeHCF and its applications in electrochemical sensors<br><br>*M. Khosravi[2a], B. Haghghi[1a], M. Amouzade Tabrizi[3a]* | ۱۶:۲۰-۱۶:۴۰ |
| ۱۵ | سخنرانی علمی کد 296 با عنوان:<br>The electrochemical synthesis of new indoyl-phthalazines derivatives<br><br>Pari Mirahmadpour[1], Saied Saeed Hosseiny Davarani[2], Davood Nematollahi[3] | ۱۶:۴۰-۱۷:۰۰ |
| ۱۶ | سخنرانی علمی کد 307 با عنوان:<br>Electrocatalytic reduction of carbon dioxide by a dinuclear Rhenium (I) complex [Re Cl (CO) 3 (μ-tptzH) Re (CO) 3]<br><br>B. Rezaei[1], M. Mokhtarianpour[2], A.A. Ensafi[3], H. Hadadzadeh[4] | ۱۷:۰۰-۱۷:۲۰ |

| سالن شماره(۱) سالن جابربن حیان | | |
|---|---|---|
| **پنجشنبه۱۳۹۲/۹/۱۴**<br>**ارائه مقالات همایش** | | |
| **ردیف** | **موضوع: کربن نانو لوله ها، گرافن، خوردگی و الکتروشیمی فیزیکی وتجزیه ایی** | **زمان** |
| **هیات رئیسه: خانم دکتر جوادیان و آقای دکتر شکرالهی** | | |
| ۱ | Invited speaker<br>**عنوان سخنرانی**<br>Potentiometric measurements using ion-selective electrodes for activity coefficients determination and thermodynamic modeling of electrolyte solutions<br>دکتر بهرام قلمی | ۸:۰۰-۸:۳۰ |
| ۲ | سخنرانی علمی کد 398 با عنوان:<br>Metalic Nanoparticles Embeded in Ionic Liquid Derived Ordered Mesoporous Carbon: Electrocatalytic Performance toward Oxygen Reduction Reaction<br>F. Nazari Baghak, M. Rafiee* and B. Karimi | ۸:۵۰-۸:۳۰ |
| ۳ | سخنرانی علمی کد 416 با عنوان:<br>The potential of electrochemical processes in petrochemical industry<br>M.Hosseini Aliabadi* | ۸:۵-۹:۱۰ |
| ۴ | سخنرانی علمی کد 234 با عنوان:<br>Comparison of MnO2 hydrothermal synthesis and electro deposition on graphene for super capacitor applications<br>Hamideh Kalhor, Hanif Kazerooni a *, Hamidreza Ghenaatian b * and AlireaNaari | ۹:۱۰-۹:۳۰ |
| ۵ | سخنرانی علمی کد 289 با عنوان:<br>Electrosynthesis of Pt-Co alloy nanoparticles and its electrocatalytic activity towards the ethanol oxidation in acidic media<br>B. habibi*, K. Rahmani | ۹:۳۰-۹:۵۰ |

| | | |
|---|---|---|
| ۶ | پذیرایی و بازدید از پوسترها | ۹:۵۰-۱۰:۳۰ |
| **موضوع: کربن نانو لوله ها، گرافن، خوردگی و الکتروشیمی فیزیکی وتجزیه ایی** | | |
| **هیات رئیسه: آقای دکتربهرام قلمی چوبر و خانم دکتر رضوی زاده** | | |
| ۷ | سخنرانی علمی کد 388 با عنوان:<br>Thermodynamic study of the (CaCl2+alanine+water) system using modified nanotube sensor<br>P. Mossayyebzadeh-Shalkoohi[1], B. Ghalami-Choobar[2] | ۱۰:۳۰-۱۰:۵۰ |
| ۸ | سخنرانی علمی کد 236 با عنوان:<br>Investigation Mixed surfactant system for dispersion of multiwalled carbon nanotubes(MWNTs)<br>Nima. Dalir[1] Hashem. Moradi[2] Soheila. Javadian[3] | ۱۰:۵۰-۱۱:۱۰ |
| ۹ | سخنرانی علمی کد**۳۷۷**با عنوان:<br>Simultaneous determination of isoproterenol, acetaminophen and tryptophan using a nanocomposite-based electrochemical sensor<br>Mahbobeh Moazampour and Hassan Karimi-Maleh | ۱۱:۱۰-۱۱:۳۰ |
| ۱۰ | سخنرانی علمی کد178با عنوان:<br>CdS/TiO2/Graphene Nanocomposite Photoanode for Enhanced Photoelectrochemical Performance<br>S.Yousefzadeh1, A.Rahimi[2], M.Faraji[3] and A.Z. Moshfegh[*4] | ۱۱:۳۰-۱۱:۵۰ |
| ۱۱ | سخنرانی علمی کد312با عنوان:<br>Electrodeposition of Graphene Film on Indium Thin Oxide Regarding Water Base Solution; a Mechanism Study<br>Y.Yaghoubinezhad[1] , A.Afshar[2] | ۱۱:۵۰-۱۲:۱۰ |
| ۱۲ | سخنرانی علمی کد۳۷۴با عنوان:<br>Corrosion Inhibition of St-37 Rotating Disc Electrode in 3.5% NaCl Solution by L-valine-Disodium hydrogen phosphate System | ۱۲:۱۰-۱۲:۳۰ |

| | | |
|---|---|---|
| | E.Asghari[1] , H.Ashassi-sorkhabi[2] and N.Asadzadeh * | |
| ۱۲ | نهار ونماز | ۱۲:۳۰-۱۴:۰۰ |

| سالن شماره(۲)سالن سمینار دانشکده علوم پایه | | |
|---|---|---|
| **پنجشنبه۱۳۹۲/۹/۱۴**<br>**ارائه مقالات همایش** | | |
| **ردیف** | **موضوع: الکتروشیمی فیزیکی وتجزیه ایی سنتز الکتروشیمیایی** | **زمان** |
| **هیات رئیسه:آقای دکتررزمی و خانم دکتر بهرامی پناه** | | |
| ۱ | Invited speaker<br>**Application of fast Fourier Transforms in modern Electroanalytical Methods**<br>**دکتر نوروزی** | ۸:۰۰-۸:۳۰ |
| ۲ | سخنرانی علمی کد ۳۶۵با عنوان:<br>Study of porosity of conducting polymers electrodes with using FFT admittance spectroscopy method for supercapacitor application<br>J. Shabani Shayeh[۱] , P. Norouzi[۱] , M. R. Gangali[۱] | ۸:۵۰-۸:۳۰ |
| ۳ | سخنرانی علمی کد 190 با عنوان:<br>The investigation of electron transfer of glucose Oxidase at graphene and graphene-cysteine modified electrode<br>H.Naserimoghadam[1], H.Ghourchian[2], and A. Divsalar[3] | ۸:۵-۹:۱۰ |
| ۴ | سخنرانی علمی کد 292 با عنوان:<br>A Simple Method for Electrochemical Synthesis of Coordination Polymer Coatings on Metallic Substrates<br>M.H. Banitaba[1], P. Mirahmadpour[2], S.S.H. Davarani[1], and D. Nematollahi[3] | ۹:۱۰-۹:۳۰ |
| ۵ | سخنرانی علمی کد ۴۴۵با عنوان:<br>Voltammetric Study on Chemically Synthesized Palladium Nanoclusters<br>DJafar Vatan Khah Dowlat Sara*[1], , Mojtaba Shamsipur[2], Ahmad Rouhollahi[3] | ۹:۳۰-۹:۵۰ |

| | | |
|---|---|---|
| ۶ | پذیرایی و بازدید از پوسترها | ۹:۵۰-۱۰:۳۰ |
| **موضوع: الکتروشیمی فیزیکی وتجزیه ایی و سنتز الکتروشیمیایی** | | |
| **هیات رئیسه: دکتر رحمانی فر و دکتر نوروزی** | | |
| ۷ | سخنرانی علمی کد ۴۵۱با عنوان:<br>The effect of chitosan added in electroless Ni-P-SiC plating solution on the properties of composite coatings<br>H.Ashassi-sorkhabi[1], E.Asghari[2], V.Arjmand[*] | ۱۰:۳۰-۱۰:۵۰ |
| ۸ | سخنرانی علمی کد 378 با عنوان:<br>Determination of ascorbic acid using carbon-paste electrode modified with clinoptilolite nano-particles containing hexadecyltrimethyl¬ammonium¬bromide surfacta<br>A.R. Nezamzadeh-Ejhieh[1] , S.Sharafzadeh[2] | ۱۰:۵۰-۱۱:۱۰ |
| ۹ | سخنرانی علمی کد۳۸۴با عنوان:<br>Gold Nanocages Decorated on Graphene as Electrocatalyst for Borohydride Oxidation<br>Reza Ojani*, Roudabeh Valiollahi, Jahan-Bakhsh Raoof | ۱۱:۱۰-۱۱:۳۰ |
| ۱۰ | سخنرانی علمی کد۳۸۳با عنوان:<br>Functionalized SBA-15 /Au nano particles modified SPE for investigation of Gquadruplex-drug interaction<br>Zahra Bagheryan, Jahan-Bakhsh Raoof, Reza Ojani | ۱۱:۳۰-۱۱:۵۰ |
| ۱۱ | سخنرانی علمی کد 206 با عنوان:<br>Voltammetric determination of acetaminophen using carbon paste electrode modified by sulfonate carbon nanopartilce Voltammetric determination of acetaminophen using carbon paste electrode modified by sulfonate carbon nanopartilce<br>M. Amiri, F. Rezapour, A. Bezaatpour | ۱۱:۵۰-۱۲:۱۰ |
| ۱۲ | | ۱۲:۱۰-۱۲:۳۰ |

| | | |
|---|---|---|
| | سخنرانی علمی کد 244 با عنوان:<br><br>Optimization and Evaluation of Electrochemical Generation of Volatile Silver and Copper Hydrides by QTA-AAS<br><br>M.H. Arbab-Zavar[1] , M. Chamsaz[1] , A. Youssefi[2] , M. Aliakbari[1] | |
| ۱۲:۳۰-۱۴:۰۰ | نهار ونماز | ۱۲ |

| جلسه اختتامیه همایش<br>پنجشنبه ۹۲/۹/۱۴<br>سالن جابربن حیان | | |
|---|---|---|
| **ردیف** | **موضوع** | **زمان** |
| ۱ | تلاوت آیاتی از قران مجید | ۱۳:۳۰-۱۳:۳۵ |
| ۲ | سرود جمهوری اسلامی ایران | ۱۳:۳۵- ۱۳:۴۰ |
| ۳ | سخنرانی جناب آقای دکتر وحید احمدی معاون پژوهشی وزارت علوم تحقیقات و فناوری<br>با موضوع<br>دیپلماسی علمی و موفقعیت های جمهوری اسلامی ایران در علم وفناوری<br>به همراه پرسش و پاسخ | ۱۳:۴۰-۱۵:۴۰ |
| ۴ | گزارش دبیر سمینار | ۱۵:۴۰-۱۵:۵۰ |
| ۵ | مجمع عمومی سالانه انجمن الکتروشیمی ایران | ۱۵:۵۰-۱۶:۰۰ |
| ۶ | مراسم تقدیر از دانشجویان نمونه دکترا و ارشد | ۱۶:۰۰-۱۶:۳۰ |
| ۷ | مراسم تقدیر از کمیته اجرایی | ۱۶:۱۰-۱۶:۲۰ |
| ۸ | ارائه گواهی مقالات | ۱۶:۲۰-۱۷:۰۰ |

# برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش اول-
# جهارشنبه ۱۰:۴۰-۱۰:۰۰ با محور باتری و پیل سوختی

| | | |
|---|---|---|
| P1 | Synthesis of Nano Composite TiO2 Nanotube/SnO2-Pt/C as Anode Materials for Li Ion Batteries | حمیده کاشانی، حسین غریبی |
| P2 | Effect of nano electrolytic MnO2 on charge/discharge cyclic of zinc/alkaline batteries | محمد رضا سویزی، محبوبه رجایی |
| P3 | Electron transport of GaN nanoribbons using non-equilibrium Green function | مژگان سعیدی |
| P4 | CdS/TiO2/Graphene Nanocomposite Photoanode for Enhanced Photoelectrochemical Performance | علیرضا مشفق، سمیرا یوسف زاده، علیرضا رحیمی، منیره فرجی |
| P5 | Ephedra Sarcocarpa extract as Green Corrosion Inhibitor for Copper in Acidic Media | فاطمه سادات حسینی، مهدی شبانی نوش آبادی |
| P6 | Plasmonic photocatalyst system using Ag/AgBr/ mordenite nanocrystal under visible light | علیرضا رضایی، پرستو سرایی |
| P7 | Aqueous synthesis and characterization of CdS quantum dots capped with some amino acids and investigations of their photo catalytic activities | عبدالرئوف صمدی میبدی، فاطمه عباسی |
| P8 | Electroplating Nano Crystalline Nickel for Increasing of Hardness | داوود حاجي نژاد، مرتضي بقالها، ابراهيم مصلي نژاد |
| P9 | Electroplating Nano Crystalline Nickel for Reduction of Corrosion rate | داوود حاجي نژاد، مرتضي بقالها، ابراهيم مصلي نژاد |
| P10 | Comparision the Performance of the Optimized PtSn and Commercial PtRu in a Passive DMFC | میترا امانی، حسن پهلوانزاده، حسین غریبی، محمد کاظمینی |
| P11 | Impedance Response Analysis of PEM Fuel Cell under Different Operation Conditions | سمیه مجیدی، محمد ژیانی، محمد محمدی تقی ابادی |
| P12 | Nanostructured bimetallic Pt-Pd alloy on functionalized carbon supports as PEMFC electrocatalysts for oxygen reduction reaction | فاطمه یاسی، حسین غریبی، احمد حیدری |
| P13 | novel composition for anode aand cathode in biofuel cell | فریده گورانلو |
| P14 | PAN Fiber Composite of Carbon Materials as Carbon Fiber Paper in PEM Fuel Cells | عارف عرب صاحبی، مجید قاسمی، مهدی خیرمند |
| P15 | Performance Analysis of a PEM Fuel Cell at Different Cathode Relative Humidity | سمیه مجیدی، اسماعیل محمدی، محمد ژیانی |
| P16 | Poly electrolyte assisted syntheses of graphene supported Pt nanoparticles as electrocatalyst for Oxygen reduction reaction | منیره فرجی، حسین غریبی |
| P17 | Preparation of Nitrogen Doped Graphene as a new Platinum Support in PEMFCs | احمد حیدری، حسین غریبی، فاطمه یاسی |
| P18 | Pt-SnO2/C Electrocatalyst for Ethanol Oxidation in Acid environment | صادق صادقی، حسین غریبی |
| P19 | Sensing of anti-HIV drug zidovudine on Ag nanofilm-multiwalled carbon nanotubes modified glassy carbon electrode | احمدرضا افراز ، امیرعباس رفعتی |
| P20 | 2-Metyl-4-(2-Metylpyrimidine-4-yl) Pyrimidine as a Sensing material in Construction of Cr(III) Sensor | فاطمه رزاق زاده، فرهنگ میزانی |
| P21 | Application of a new Graphene¬¬-based material as agas sensor with high sensitivity for detection and determination of Ethanol vapor | فرزانه احمدیان، طاهر علیزاده |
| P22 | Conducting Polypyrrole Film Doped with Anionic Chromotropic Acid as a Solid State Potentiometric Sensor for Cr(VI) | نرجس اشرف، محمد حسین ارباب زوار، مارال محروقی |
| P23 | Determination of Iron(III) by a Novel Potentiometric sensor and Its Application in Pharmaceutical Analysis | مرضیه حیاتی، فرهنگ میزانی |
| P24 | Determination of Trace amount of Ferric Ions with a Novel Liquid Membrane Electrode | شبنم قاسمی، فرهنگ میزانی |
| P25 | Development of new Sn(II) – Ion selective membrane electrode based on 2,3-Diphenyl Pyrido [3,2-b] Pyrazine | مونا ملکی ها، فرهنگ میزانی |
| P26 | Electrochemical determination of gallic acid using glassy carbon | فرشته چکین، جهان بخش رئوف |

## برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش اول-
## جهارشنبه ۱۰:۴۰-۱۰:۰۰ با محور باتری و پیل سوختی

| | | |
|---|---|---|
| | electrode modified with gelatin functionalized graphene nanosheet | |
| P27 | Fabrication and Characterization of a Carbon Nanotube Based Methane Sensor | سجاد دهقانی، محمدکاظم مروج فرشی |
| P28 | Fabrication of poly(Ani-co-OAP) on pencil graphite electrode:application to the selective voltammetric detection of acetaminophen in pharmaceutical samples | علی نعیمی، علی نعیمی، دانیال رایجی |
| P29 | Food Contaminants Detection by Bio and Immunosensors | بی بی مرضیه رضوی زاده |
| P30 | High selective methadone sensor based on ion selective electrode with Potassium tetrakis[3,5-bis-(trifluoromethyl)phenyl]borate as an ionophore | عاطفه شفاعت، مجید سلیمانی |
| P31 | Novel Ion Carrier in Costruction of PVC-Based Al(III)-Selective membrane sensor | مینا دریایی، فرهنگ میزانی |
| P32 | Sulfated β-cyclodextrin doped polypyrrole film deposited on pencil graphite as an ion selective electrode for determination of phenobarbital | نرجس اشرف، محمد حسین ارباب زوار، هانیه مددی |
| P33 | Voltammetric determination of dopamine using a ZnO nanoparticles modified carbon paste electrode | الهه ملااکبری، علی مصطفوی، هادی بیت اللهی |
| P34 | Copper nanoparticles dispersed in polyaniline matrixe coated on glassy carbon electrode as a glucose sensor | زهرا بابایی، خدیجه قنبری |
| P35 | Electrochemical Oxidation of Alanine at Quinazolin Self Assembled Monolayer Modified AgNPs/GCE | نوید نصیری زاده، زهرا شکاری، مسعود قاانی |
| P36 | Electrodeposition of CoOxNanoparticles on Graphene-Zirconium Oxide Nanocomposite: Application to Determination of H2O2 | محمد نادری، هژیر تیموریان، عبدالله سلیمی |
| P37 | Fabrication of a Small Electrochemical Sensor for Gaseous Carbon Dioxide and Its Application in Amino Acid Analysis | علی اکبر عباسی |
| P38 | First report for simultaneous voltammetric determination of methyldopa, folic acid and glycine | الهه ملااکبری، علی مصطفوی، هادی بیت اللهی |
| P39 | Gas Sensing of Polypyrrole Film Prepared by Zn(II) Catalytic Electrosynthesis on Copper Interdigital Electrodes | نادر علیزاده، آرش قورچیان |
| P40 | High Sensitive Non-enzymatic Glucose Sensor based on Ni(OH)2 Nanoparticles | میثاق عباس نیا تهرانی، محمدعلی کیانی |
| P41 | Investigation and Comparison of YSZ and Ni/Ce-YSZ as Gas Sensor | زهرا ابوالقاسمی، مرتضی تمیزی فر، کاوه ارزانی، علی نعمتی |
| P42 | Modified Carbon Paste Electrode with Carbon Nanotubes and Ionic Liquid and Decorates by Gold Nanoparticle for Dopamine Sensing | احمدرضا افراز ، امیرعباس رفعتی |
| P43 | Simultaneous Determination of Hydroxylamine and Nitrite Based on Self-Assembly of Imidazole on AgNPs/GCE | نوید نصیری زاده، مسعود قاانی، زهرا شکاری |
| P44 | ZnO @ CuO/Polypyrrole nanocomposite based sensor for simultaneous determination of ascorbic acid, dopamine and uric acid | ناهید حاج حیدری، خدیجه قنبری |
| P45 | ZrO2Nanoparticles-Reduced GrapheneOxideNanocomposite: Synthesis, Characterization and Electrochemical Sensing Application | سمیه فیروزی، عبدالله سلیمی، هژیر تیموریان، اعظم کرانی |
| P46 | Capacitive behavior of ultrathin polyaniline for high speed super capacitors | جواد شعبانی شایه، پرویز نوروزی، محمد رضا گنجعلی، نرگس آقا محمدی |
| P47 | Desalination of Brackish Water by Capacitive Deionization | فاطمه نعمت پور، محسن خسروی، ندا بشیرپور |
| P48 | Electrochemical Performance of Polyaniline-based Carbon as Electrode Material for Supercapacitor | الهام شهریاری، میر قاسم حسینی |
| P49 | Electrodeposited Co3O4 Nanostructures on Carbon Fiber | احمد اصغری |

# برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش اول-
# جهارشنبه ۱۰:۴۰-۱۰:۰۰ با محور باتری و پیل سوختی

| | | |
|---|---|---|
| | Substrate for Application in High-rate Supercapacitors | |
| P50 | Electrodeposited Ni(OH)2 nanostructures on electroc-etched carbon fiber for exceptionally stable supercapacitors | سید حبیب کاظمی، کیوان ملائی |
| P51 | study the capacitive behavior of electro-co deposited poly aniline/ Nano structural MnO2 composite using FFT continuous cyclic voltammetry. | جواد شعبانی، پرویز نوروزی، محمد رضا گنجعلی |
| P52 | A Reviwe of Refining of Secondary Lead for Use in Lead-Acid Batteries | فاطمه کریمی تبار شفیعی |
| P53 | Advance batteries | محمد رضا سویزی |
| P54 | DFT study of Hydrogen molecule Storage by Lithium cation within Boron Nitride fullerenes like in the gas phase | سیما مهدی شیشوان، جواد بهشتیان |
| P55 | Effect of carbon nanotubes (CNTs) and culture medium type (MS and B5( on in vitro germination of strawberry seeds | رحمان یوسفی، موسی موسوی، نورالله معلمی، محمدهادی غفاریان مقرب |
| P56 | First principles study of the structural and electronic properties of Zn1-xYx(Y = Cd,Mg)O nanotube | الهام فریدوني، رستم مرادیان، مسعود شاهرخي |
| P57 | Reductive Dechlorination of Carbon Tetrachloride by Copper Nanoparticles @ Graphene Oxide Composites | زهره سادات فلسفی، طاهره پور صابری، مصطفی حسنی سعدی، علی جباری |
| P58 | Voltammetric determination of tryptophan using modified ionic liquid Pt/CNTs nanocomposite paste electrode in food samples | مژده الیاسی، حسن کریمی مله، محمد علی خلیل زاده |
| P59 | A facile method to coat mullite layer on multi- walled carbon nanotubes (MWCNTs)by anionic surfactant | مریم سیرتی گوهری، تورج عبادزاده، علیمراد رشیدی |
| P60 | A high sensitive electrochemical sensor based on Pt/CNTs nanocomposite modified carbon paste electrode for simultaneous determination of N-actylcysteine, NADH and folic acid | فهیمه طاهرنژاد جوزمی، حسن کریمی مله، علی اصغر انصافی |
| P61 | A New Approach to Synthesis of Electrochemically Reduced Graphene Oxide; Galva pulse Method | یدالله یعقوبی نژاد، عبدالله افشار |
| P62 | Application of nanomaterials for fabrication of ERBB2 sensitive aptasensor | نورالله محمدی مصیری، عبدالله نوربخش رضایی، ماندانا بهبهانی، محمد خاکپور کنف گورابی |
| P63 | Covalent functionalization of carbon nanoparticles for extraction and electrochemical determination of dopamine | ماندانا امیری، هادی عینکی، یعقوب منصوری |
| P64 | Dispersion of graphene in aqueous solutions with Triton X-100 surfactant | هاشم مرادی |
| P65 | Electrochemical Behavior and Electrocatalytic Activity of Imidazole/MWCNT modified GCE as a Hydrazine Sensor | نوید نصیری زاده، مسعود روحانی مقدم، زهرا شکاری |
| P66 | Fabrication and Characterization of ZnO/Graphene/CdS Ternary Nanocomposite for Photoelectrochemical application | علیرضا مشفق، عمران مرادلو، محمد امین نورمحمدی |
| P67 | Glucose Biosensor by Usage Graphene Oxide-Multiwalled Carbon Nanotube Hybrids by Microwave Irradiation Modified Glassy Carbon Electrode | هدایت الله قورچیان، A.A Athawale، مصطفی شوریان، لیلا شهریاری |
| P68 | Graphene- graphene oxide- graphite/conducting polymer nanocomposites as supercapacitor electrods | خدیجه دیده بان، ریحانه دهقان |
| P69 | Green synthesis of reduced graphene oxide decorated with gold nanoparticles by rose water as reducing agent and its glucose sensing application | محمود عموزاده تبریزی، بهزاد حقیقی |
| P70 | Simultaneous Determination of AA, LD, UA, Insulin and ASA Using Trifunctional Electrochemical Sensor | نوید نصیری زاده، زهرا شکاری، مسعود قاانی |
| P71 | Synthesis of magnetic Iron oxide-Reduced graphene oxide (RGO) nano-composite for aptamer immobilization | محمد خاکپور کنف گورابی، عبدالله نوربخش رضایی، نورالله محمدی مصیری |

## برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش اول-
## جهارشنبه ۱۰:۴۰-۱۰:۰۰ با محور باتری و پیل سوختی

| | | |
|---|---|---|
| P72 | Toxic CO detection by Lithium cation Boron Nitride endofullrenes like nanocluster in the gaseous phase | سیما مهدی شیشوان، جواد بهشتیان |
| P73 | Toxic CO detection by Potassium cationic within Boron Nitride fullerenes like via DFT study in the gaseous phase | سیما مهدی شیشوان، جواد بهشتیان |
| P74 | Voltammetric determination of sudan I in Ketchup and Chilli powder using modified ionic liquid nanocomposite paste electrode | مژده الیاسی، حسن کریمی مله، محمدعلی خلیل زاده |
| P75 | effect of carbon nanotubes on the electrical conductivity of polyurethane /multiwalled carbon nanotubes foam | ماندانا قائمی، مجید بنی آدم، مرتضی مغربی |
| P76 | Effect of Ionic liquid on Electrical Conductivity of Epoxy resin/CNT Nanocomposites | هرمز غلامی، مرتضی مغربی، مجید بنی آدم |
| P77 | Synthesis and electrical characterization of polyaniline / multiwalled carbon nanotubes / resin epoxy composite | طاهره فقیه، مجید بنی آدم، مرتضی مغربی |
| P78 | Synthesis, characterization and thermal properties of Fe2TiO5/ cellulose and cellulose acetate nanocomposite | قدم حسینی، صلاح خان احمد زاده |
| P79 | Synthesis, Characterization and Thermal Properties of Fe2TiO5/polyaniline Nanocomposites | شیدا سالک، صلاح خان احمد زاده |
| P80 | Determination of thermodynamic parameters of hydrogen permeation through palladium layer in Pd/oxPSS composite membrane | حسین غریبی، علیرضا ذوالفقاری، محمد امیر سعادتی نسب |

**برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش دوم- جهارشنبه ۱۶:۰۰-۱۵:۲۰ با محور خوردگی- نانو لوله ها -گرافن ها- حسگر و سنتز الکتروشیمی**

| | | |
|---|---|---|
| p1 | A Novel Electrochemical Sensor for Determination of Creatinine Based Carbon Nanofiber/ Cu-Nanowire &Ionic Liquid | بهنوش خاموشی، سمیه قادری، رحمان حلاج |
| p2 | Electrocatalytic and simultaneous determination of ascorbic acid, nicotinamide adenine dinucleotide and folic acid at ruthenium (II) complex-ZnO/CNTs nanocomposite modified carbon paste electrode | علی اصغر انصافی، حسن حدادزاده، مرضیه |
| p3 | Electrocatalytic determination of homocysteine, acetaminophen and folic acid using modified nanocomposite carbon paste electrode | فهیمه طاهرنژاد جوزمی، حسن کریمی مله، علی اصغر انصافی |
| p4 | Electrochemical Behavior and Determination of Phenylephrine at Room Temperature Ionic Liquid/Multi-Walled Carbon Nanotube Modified Electrode in the Presence of Acetaminophen | بیوک حبیبی، فیروز زالوند |
| p5 | Electro-oxidation and determination of acyclovir at glassy carbon electrode modified with an imidazolium-based ionic liquid and Pt nanoparticles | احمد روح الهی، معصومه تاج آبادی |
| p6 | Investigation of The Effects of Gelatin on The Quality of Deposits on Different Cathodes in Lead Electrodeposition Process in a Fluoborate Medium | وحید آبیک آبادی، نقی سعادتجو، احمد عبداللهی |
| p7 | Investigation of the Effects of Operational Parameters on Lead Electrorefining in a Fluoborate Medium for Cathodic Process | وحید آبیک آبادی، نقی سعادتجو، احمد عبداللهی |
| p8 | Kinetic study of chloromethylation of polystyrene in the presence of ionic liquids | علی اکبر افکار |
| p9 | Modified Electrode Based on Electroactive Ionic Liquid Functionalized Mesoporous Silica | محمد رفیعی، بابک کریمی، سیده کبری زوارموسوی |
| p10 | Numerical simulation of mass transfer in wool textile with consideration of electric double layer | محمدرضا سیدنژاد، قاسم حیدری نژاد، هادی پاسدارشهری |
| p11 | Preparation of an electrochemical bionanosensor for quercetin determination in food samples | آزاده کمالی، حسن کریمی مله |
| p12 | Synthsis of ZnO nanoparticles and application of it in preparation of epinephrine electrochemical sensor | رویا صادقی، حسن کریمی مله |
| p13 | Thermodynamic study of the (NaCl+Urea+Water) system using potentiometric method | داریوش نژادی سلامی، بهرام قلمی چوبر |
| p14 | Voltammetric determination of carbidopa using an ionic liquid modified carbon paste electrode | هادی بیت الهی، سعید رستمی، رضا علی زاده، حسن کریمی مله |
| p15 | The application of Silver Compounds/TiO2 Nanoparticles in Watersplitting for Hydrogen | مریم عظیم زاده ایرانی، حسین غریبی |

**برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش دوم- جهارشنبه ۱۶:۰۰-۱۵:۲۰ با محور خوردگی- نانو لوله ها -گرافن ها- حسگر و سنتز الکتروشیمی**

| | | |
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| | production | |
| p16 | Determination of Chlorpromazine on the Surface Glassy Carbon Electrode Modified by Nickel Oxide Nanoparticles | طاهره خراسانی، عبدالله نوربخش |
| p17 | Electrochemical oxidation of 4-tert-butylcatechol in the presence of anilinederivatives | داوود نعمت الهی، بهاره فیضی برناجی، آمنه امانی |
| p18 | Electrochemical synthesis of new acetaminophenderivatives | داوود نعمت الهی، بهاره فیضی برناجی، آمنه امانی |
| p19 | Electrodeposition of Gold Nanosturctures on FDTO | جعفر وطن خواه دولت سرا |
| p20 | Magnetic Field Effect on The Pulse Electrosynthesis of Iron Nanoparticles | ژولیت اردوخانیان، شهلا مظفری، حسن کرمی |
| p21 | Optimization of conditions pulsed electropolymerization aniline- pyrrole copolymer nanoparticles | سمانه جعفري، حسن کرمي |
| p22 | Raman spectroscopy of polyaniline/graphen nanocomposite modified electrode and its electrocatalytic activity on hydroquinone | الهه سادات موسوی خرد، علی پارسا، سوسن صمدی |
| p23 | The electrocatalytic behavior of Pd supported on nanoporous stainless steel in glycerol electrooxidation | الهه هواکشیان، علی اصغر انصافی، بهزاد رضایی |
| p24 | The electrosynthesis of propylene oxide | مریم حسینی علی آبادی |
| p25 | A New Aflatoxin B1 Biosensor Based on Bi-Enzymes Covalently Immobilized on Self-assembled Monolayer on Gold Electrode | مریم محمودابادی |
| p26 | Corrosion protection of Steel by Chemically and Electrochemically Deposited Polyaniline/Silica Nanocomposites | محمد فتاحی امیردهی، جواد فصیحی، محمد ماهانی |
| p27 | Effect of SMAT pre-Processing on MAO-Fabricated Nanocomposite Coating on AZ31B Magnesium Alloy | مرتضی قیطانی، محمود علی اف خضرائی، علیرضا صبور روح اقدم |
| p28 | Electrochemical determination of Simvastatin using pyrolytic carbon electrode in pharmaceutical formulation | زهرا نظری، شهلا مظفری |
| p29 | Electrodeposition of Platinum on Semiconductor Electrode in Molten Salt Media and Its Catalytic Applications | احمد روح الهی، سپیده زنده دل |
| p30 | Structural Effect on Nucleophilic Addition of Aniline Derivatives to Noradrenaline | فاطمه بابالوئی، لیدا خلفی |
| p31 | Study of dipicolinic Acid / 2,2'- diprydilamine proton- transfer system by potentiometric method | اردشیر شکرالهی، فرشته ضرغامپور |
| p32 | Study of electrochemical activity of platinum on zinc oxide electrocatalyst for oxygen reduction reaction in presence of Vulcanin reaction layer | رسول عبداله میرزایی، فاطمه حامدی، محمد صفی رحمانی فر |
| p33 | Surface decoration of multi-walled carbon nanotubes modified carbon paste electrode with gold nanoparticles for sensitive | عباس افخمی، فرزانه سلطانی فعله گری، طیبه مدرکیان |

**برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش دوم- جهارشنبه ۱۶:۰۰-۱۵:۲۰ با محور خوردگی- نانو لوله ها -گرافن ها- حسگر و سنتز الکتروشیمی**

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|---|---|---|
| | determination of methadone in biological samples | |
| p34 | Synthsis of NiO, MgO, ZnO nanoparticles and investigation of them in charge transfer resistan reduction using electrochemical impedance spectroscopy | فهیمه کاظمی پور برواتی، محمد حسین طیرانی نجاران، حسن کریمی مله |
| p35 | The Investigation of Novel Glucose oxidase Biosensor Based on Graphene-Clay nanocomposite | خدیجه اسکندری |
| p36 | Voltammetric determination of amlodipine besylate at surface of glassy carbon electrode modified using sulfonate carbon nanoparticles | ماندانا امیری، حمیده ایمان زاده |
| p37 | Voltammetric Determination of Dichromate Using Carbon-Past Electrode Containing Clinoptilolite nanoprticles Modified with surfactant | علیرضا نظام زاده اژیه، مرضیه صالحی |
| p38 | Voltammetric determination of paracetamol using carbon paste electrode modified with Cu(II)-ion exchanged clinoptilolite nanoparticles | داود همتی، علیرضا نظامزاده اژیه |
| p39 | Voltammetric Measurements of Cesium ions Using Carbon paste Electrode Modified with clinopitilolite nanoparticles containing HDTMA and Arsenazo (III) | مهدی سعادت، علیرضا نظام زاده |
| p40 | ZnO/CNTs nanocomposite as a sensor and a catechol derivative as a mediator for determination of captopril in pharmaceutical and biological samples | محبوبه معظم پور، حسن کریمی مله، مهدی یوسفیان |
| p41 | Effects of 2,3-dihydroxy (3-hydroxyphenyl) aldimine on copper corrosion as a corrosion inhibitor in acidic solution | فائزه سادات رضوی، محسن بهپور |
| p42 | Green Approach to Corrosion Inhibition of Copper in Acidic Solution by the Extract of Calligonum Comosum | فاطمه سادات حسینی، مهدی شبانی نوش آبادی |
| p43 | Growth and Wettability of Micro-arc Oxidized MgO-based Nanocomposite Coating | حمیدرضا باقری، محمود علی اف خضرایی، تقی شهرابی |
| p44 | Investigation of anodic oxidation of PAN-based carbon fibres in NaOH and HNO3 electrolytes | حمید اشکنانی، محمد آندیده |
| p45 | Investigation of the Inhibition of Copper Corrosion by Thioridazine Self-assembled Film | محسن بهپور، نرگس محمدی، شکوفه رمضانلو |
| p46 | Turmeric and Pepper as Green Corrosion Inhibitors forCopper in H2SO4 | هادی عادل خانی خدیجه دیده بان، افسانه مجتهدزاده اصل |
| p47 | Electrodeposited Poly(O-anisidine) Coatings on Aluminum Alloy 5052: Synthesis,Characterization and Corrosion Protection Evaluation | مهدی شبانی نوش آبادی، علیرضا بیابان نورد |
| p48 | Controlable Synthesis of Anodic Aluminium Oxide Template for Preparing of One | آزاده ناظمی |

**برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش دوم- جهارشنبه ۱۶:۰۰-۱۵:۲۰ با محور خوردگی- نانو لوله ها -گرافن ها- حسگر و سنتز الکتروشیمی**

| | | |
|---|---|---|
| | Dimensional Nanostructures | |
| p49 | DPPH radical scavenging activity of polyaniline/graphene nanocomposite modified electrode prepared in phosphoric acid medium | سارا امن زاده سلوط، علی پارسا، علی مظلومی فر |
| p50 | Electrochemical Study of the MCM-41 Supported NHPI as Catalyst for Green Oxidation of Alkylbenzenes | محمد رفیعی، بابک کریمی، فاطمه کلهری |
| p51 | Electro-oxidation of Hydrazine Catalyzed by the Porous Nanostructured Ni/AuNi Electrode | مهدی عبدالملکی، ایرج احدزاده، ایمان نظری حقیقی، میرقاسم حسینی |
| p52 | Evaluation of cathode material effects on methanol reductive production from carbon dioxide and formic acid; mechanistic and electrocatalytic features | بي تا دادپو، ارش ربيعي |
| p53 | Synthesis of Bi-2212 superconductor nano particles by electrodeposition process | مجتبی احمدی، هوشنگ عراقی، هادی عادلخانی |
| p54 | Synthesis, Characterization and investigation of nitrilotriacetic acid (NTA) using cysteine on gold electrode surface | مرتضی سرپرست، هدا ایلخانی، نسرین مرادی، میرفضل اله موسوی |
| p55 | Electrochemical investigation of atmospheric leaching of sphalerite in sulphate solution | سید محمد جواد کلینی، حسین مهرپویا، محمود عبداللهی، حسین یوزباشی |
| p56 | Electrochemical evaluation of the effect of temperature on the corrosion behaviour of Admiralty Brass alloy in thermal power plant condenser | خدیجه ابوطالبی |
| p57 | Electrochemical investigation of adsorption and inhibitory of 1,4-Ph(OX)2(Ts)2 on corrosion of aluminium in acidic media | علي احساني، محمود نصراله زاده |
| p58 | Preparation and study of the corrosion behavior of electrodeposited Ni-Fe and Ni-Fe-C nanostructures coatings in 1M NaOH | هادی مرادی، علیرضا مادرام |
| p59 | Study of Pitting Corrosion on Copper Using Some Imidazoles; A Computational Study | حمیده کلهر، آرش قورچیان |
| p60 | A Study on the Corrosion Inhibition of Copper by Ethanolamines in the presence of BTAH | علیرضا رحیمي، مصیب چقازردي، علیرضا رضایي راد |
| p61 | Corrosion inhibition of mild steel in hydrochloric acid solution using ionic liquid and surfactant | علی یوسفی، سهیلا جوادیان |
| p62 | Experimental investigation of 2-Methoxy-4-(2H-tetrazole-5-yl)phenol on the corrosion of Aluminium in 1M HCl | ندا ابراهیمی |
| p63 | Investigation of Self-Healing Coatings Based on Microcapsules Containing CeO2 Nano Particles by EIS and EN Techniques | مهدی شهیدی، مریم کاظمی پور، مجده حسن زاده |
| p64 | Adsorption and corrosion inhibition of Allium hirtifolium extract on carbon steel corrosion in H2SO4 acidic media | نسرین سلطانی، ناهید توکلی، صدیقه حیدری |
| p65 | Corrosion behavior of Hot-Dip galvanized | علی مصباح زاده، عباس افراسیابی گرکانی |

**برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش دوم- جهارشنبه ۱۶:۰۰-۱۵:۲۰ با محور خوردگی- نانو لوله ها -گرافن ها- حسگر و سنتز الکتروشیمی**

| | | |
|---|---|---|
| | steel sheets in Zn-5%Al,coated in different conditions | |
| p66 | Corrosion inhibition of aluminium in alkaline media by Berberis vulgaris root extracted | محمد رضا سویزی، سیده مکیه تشکر سجادی |
| p67 | Inhibition of the Corrosion of Carbon Steel in HCl Solution by Pistacia Terebinthus Extract | نسرین سلطانی، ناهید توکلی، بتول کریمی |
| p68 | Carbon ceramic electrode modified by platinum nanoparticles dispersed into polyaniline film for methanol electrooxidation | پریسا حمیدی، حبیب رزمی |
| p69 | Effect of Nafion content on cathode catalyst layer void volume and PEMFC performance | محمد ژیانی، محسن کیوان نژاد |
| p70 | Electrocatalytic Oxidation of Methanol by Ni-Clinoptilolite Zeolite Nanoparticles Modified Carbon Paste Electrode | علیرضا نظام زاده اژیه، محمد حسین شیخ محسنی |
| p71 | Preparation and Comparison of Nonprecious Metal Catalyst Activity for Oxygen Reduction Reaction | سوسن روشن ضمیر، باقر کاظمی نسب، محمد جواد پرنیان، حسنا قنبرلو |
| p72 | Synthesis of Aluminium doped Manganese Dioxide by means of an Electrochemical/Chemical method | سید سعید سید حسینی، طاهر یوسفی، حمید رضا معظمی |
| p73 | Zinc-Bismuth Alloy powder produced by the electrolytic deposition | علی مصباح زاده، میثم جوکار |
| p74 | Determination of thermodynamic parameters of hydrogen permeation through palladium layer in Pd/oxPSS composite membrane | حسین غریبی، علیرضا ذوالفقاری، محمد امیر سعادتی نسب |
| p75 | Effect of Redox Potential on the thermophilic Bioleaching of Chalcopyrite | محمود عبداللهی، سید محمد موسوی، احمد خدادادی، محمد رضا صمدزاده یزدی |
| p76 | Effect of surface nanocrystallization on corrosion of aluminum alloy treated by post plasma electrolytic oxidation | حمیدرضا مسیحا، علیرضا صبور روح اقدم، محمود علی اف خضرائی |
| p77 | Mulberry as Green Corrosion Inhibitor of Steel in Hydrochloric Acid | محمدحسین قربانی، رضا فضایلی، آرش قورچیان |
| p78 | Passivity of 304 Stainless steel in Alkaline Solution by Mott-Schottky Analysis, EIS and Polarization Measurements | احمدرضا دورعلی بنی، سمیه مجیدی، اسماعیل محمدی |
| p79 | Schiff base as corrosion inhibitor for aluminium in HCl solution | جواد شعبانی شایه، مهدی عربی، نرگس آقا محمدی |
| p80 | The Electrochemical Behavior of 304 Stainless steel in Alkaline Solutions in the Presence of Chlorides | احمدرضا دورعلی بنی، سمیه مجیدی، اسماعیل محمدی |

## برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش سوم-
## پنجشنبه ۱۰:۳۰-۹:۵۰ با محور الکتروشیمی شیمی فیزیکی و تجزیه ای

| | | |
|---|---|---|
| P1 | A survey upon Direct electrocatalysis of hemoglobin in a multilayer {nanobarium=PDDA}n hybrid film | کورش متولی، زهرا یعقوبی |
| P2 | Application of Nanoparticles and Molecularly Imprinted Polymer as Modifier for Fabrication of Electrochemical Sensor for Determination of Trace Amounts of Morphine | شروین فروغی دهنوی، علی اصغر انصافی، بهزاد رضائی |
| P3 | Design and fabrication of a pH Electrode based on modified Fe2O3 nanoparticles | فریبا جمشیدی، طاهر علیزاده |
| P4 | Dielectric and impdance spectroscopy characterization of nano electro copolymerization of aniline and 2,4dinitrophenol in Phosphoric Acid Medium | ابتسام سبحانی، علی پارسا، فرنوش فرید بد |
| P5 | Doping of magnetic Fe atoms on semiconductor nano particle CdSe their effects on optical and magnetic properties | الهام فريدوني، رستم مراديان، مسعود شاهرخي |
| P6 | Effect of a nano-gallium thin layer upon the electrode surface for detecting biomolecules | کورش متولی |
| P7 | Electrocatalytical Effects Studies of Modified Electrode by Aniline and 2-4 dinitrophenol in Cr Solution | آسیه فلاحی گزل آباد حصار، علی پارسا، سوسن صمدی |
| P8 | Electrochemical Impedance Spectroscopic Study of polypyrrole/polyaniline composite electrosynthesized in aqueous medium | مصطفی ملکی محمود آبادی، علی پارسا، خداداد نظری |
| P9 | Fabrication and electrochemical investigations of the sensors based on metal nano-particles composite modified carbon electrodes and their applications in simultaneous trace determinations of Epinephrine,Indomethacin and Acetaminophen and some other compounds | الهام انصاری، علی بابایی، مسعود سهرابی |
| P10 | Investigation of voltammetric behavior of metronidazole using carbon paste electrode modified with nano clinoptilolite particles Cu(II)-exchanged | علیرضا نظام زاده اژیه، الهه شاه نظری |
| P11 | Kinetic Study of the Electrocatalytic Oxidation of Alcohols in the Presence Of N-Hydroxysuccinimide | زهرا جباری موروئی، لیدا خلفی |
| P12 | Kinetic Study of the Electrocatalytic Oxidation of Dopamine on Silver Fluoride Modified Silver Electrode | قاسم کریم نژاد، سارا پاشازاده، علی پاشازاده |
| P13 | pH and Salting-out Effects on Cefalexin Partitioning in Aqueous Biphasic Systems (TWEEN 20+Na3Citrate/MgSO4) | غلامرضا پازوکی، میلاد تقوی وند |
| P14 | Polytetrafluorethylene Film-Based Liquid-Three Phase Micro Extraction Coupled with Differential Pulse Voltammetry for The Determination of Atorvastatin Calcium | الهه سادات خدامی، بهزاد رضایی، علی اصغر انصافی |

**برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش سوم-**

**پنجشنبه ۱۰:۳۰-۹:۵۰ با محور الکتروشیمی شیمی فیزیکی و تجزیه ای**

| | | |
|---|---|---|
| P15 | Potentiometric Determination of Oxalate by Surfactant -Modifide Nano-Sized Clinoptilolite Electrode with High Selectivity | علیرضا نظام زاده ازیه |
| P16 | Potentiometric investigation of 2,5 pyridine dicarboxylic acid - pipyrazine proton-transfer system and it's complexes with some metal ions | اردشیر شکرالهی، افسانه فرازمند |
| P17 | Potentiometric studies of dipicolinic acid -3,4-diaminopyridine - Ca2+- M2+ ion quaternary system using Hyperquad program | اردشیر شکرالهی، فرشته ضرغامپور |
| P18 | Preparation Ag/NaA nanozeolite and its application to determination of H2O2 | سید ناصر عزیزی، شهرام قاسمی، مهرناز میخ چیان |
| P19 | Silver Chloride Modified Carbon Paste Electrode: Application to Electrocatalytic Oxidation of Ethanol | قاسم کریم نژاد، سارا پاشازاده، علی پاشازاده |
| P20 | Simultaneous Determination of Epinephrine and Ascorbic Acid Using Carbon Paste Modified Electrode | محسن بهپور، سعید معصوم، مرضیه مشکی |
| P21 | Simultaneous Determination of Sulfamethoxazole and Sulfametizol Using Carbon Paste Modified Electrode | مرضیه مشکی |
| P22 | Solvent Effects on Redox Behavior of N,N-Dimethyl Phenylene Diamine | آرش ربیعي، داوود نعمت اللهي |
| P23 | A Facile Approach for In Situ Synthesis of Nickel Oxide Nanoparticles at Multiwalled Carbon Nanotube Modified Screen Printed Electrode for Insulin Determination | علیرضا فخاری، بنفشه رفیعی |
| P24 | A Novel Aptasensor based on MWCNT-Chitosan nanocomposite for electrochemical sensing of Codeine | عباس عرب زاده، عبدالله سلیمی |
| P25 | A Novel Enzyme-free Amperometric H2O2 Sensor based on Functionalized MWCNTs Decorated with Copper Nanoparticles | ندا عسکرپور، فاطمه نیازیان، مهران غیاثی، بهزاد رضایی |
| P26 | A novel MgO/ionic liquid modified electrode for square wave voltammetric determination of methyldopa | افسانه لعل صنعتی، حسن کریمی مله |
| P27 | A novel nanocomposite carbon paste electrode for voltammetric determination of hydrazine | محبوبه معظم پور، حسن کریمی مله، هادی بیت الهی |
| P28 | A Sensitive Electrochemical Determination of Te with A New Multi-Walled Carbon Nanotube Paste Electrode | شکوفه جهانداری، محمدعلی طاهر، حمید فاضلی راد |
| P29 | Application of Metal–organic frameworks (MOFs)as catalysts for electrochemical hydrogen production | زهرا قیامتی اسفروشانی |
| P30 | Carbon paste ion selective electrode based on 15-benzo crown-5 and carbon nanotubes for determination of silver | محمود چمساز، نرجس اشرف، ابوالفضل درودی، سمیرا شوروزی |
| P31 | Construction and comparison of Lu3+ coated graphite and wire electrodes Based on 2, 2'- | فاطمه جزء یارمحمدی، حسنعلی زمانی |

**برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش سوم-**

**پنجشنبه ۱۰:۳۰-۹:۵۰ با محور الکتروشیمی شیمی فیزیکی و تجزیه ای**

| | | |
|---|---|---|
| | Dithiobis (4-methylthiazole) | |
| P32 | Construction of Selective Membrane Electrodes based on Di-tert-butyl-1-(tert-butyl thio)-1,2-hydrazine dicarboxylate | ملیحه سلطانی نژاد محمدی، حسنعلی زمانی |
| P33 | Construction of Tb3+ coated graphite and wire electrodes Based on 1, 3-Diaminopropane-N, N, N', N'-tetraacetic acid | فاطمه محمدآبادی، حسنعلی زمانی |
| P34 | Determination of Amoxicillin in urine and pharmaceutical Samples by Adsorptive Stripping Voltammetry | سعید زادخواست، حسین خانی، معصومه رستم نیا، شهریار عباسی |
| P35 | Determination of ascorbic acid in food samples using NiO Nanoparticle modified carbon paste elecrode | آزاده کمالی، حسن کریمی مله |
| P36 | Determination of diffusion coefficient and size of Gemini surfactants aggregates by cyclic voltammetry | هستي اقدس طينت، سهيلا جواديان، عليرضا تهراني بقا، حسين غريبي |
| P37 | Determination of Dopamine in real samples using PdAL2O3 nanoparticles modified carbon paste electrod | فاطمه عبدلي |
| P38 | Determination of EPinephrin by nano composite ZnFe2O4 and TiO2 Modified carbon paste electrode | محبوبه رمضانی |
| P39 | Determination of epinephrine in the presence of uric acid and folic acid using nanostructure-based electrochemical sensor | هادی بیت الهی، محمد مظلوم اردکانی، بی بی فاطمه میرجلیلی، علی اکبری |
| P40 | Determination of Fenoprofen in urine and human plasma by Adsorptive Stripping Voltammetry | سعید زادخواست، حسین خانی، شهریار عباسی |
| P41 | Determination of Hg(II) ions from aqueous solution applying solid phase extraction by Fe3O4 magnetic nanoparticles modified with poly(1,8-diaminonaphthalene) followed by adsorptive stripping voltammetry on screen-printed electrodes | سید سعید سید حسینی داورانی، عطیه توتونچی، حمید احمر، سید جمال طباطبایی رضایی |
| P42 | Electrocatalitical Effects of Homo, 2-4 dinitrophenol and Aniline Copolymer Modified Electrode in Cr Solution | آسیه فلاحی گزل آباد حصار، علی پارسا، سوسن صمدی |
| P43 | Electrocatalytic Determination of Glutathione Using Single Wall Carbon Nanotubes Paste Electrode | حسین سلطانی، هادی بیت الهی، عبدالحمید هاتفی مهرجردی |
| P44 | Electrocatalytic Oxidation of Formic Acid on a Nanoporous Co/Co-Ni-Ag Electrode in Alkaline Media | فهیمه رضائی ملایوسفی، سهراب ارشاد، میر قاسم حسینی |
| P45 | Electrocatalytic Oxidation of Glycine on Thiourea Modified Copper Electrode in Alkaline Media | قاسم کریم نژاد، فرزانه راثی، سارا پاشازاده |
| P46 | Electrocatalytical Effects Studies of Modified Electrode by Pyrrole and Potassium Chloride as Support in Cr Solution | مصطفی عابدینی، علی پارسا، علی مظلومی فر |

## برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش سوم-
## پنجشنبه ۱۰:۳۰-۹:۵۰ با محور الکتروشیمی شیمی فیزیکی و تجزیه ای

| | | |
|---|---|---|
| P47 | Electrochemical deposition of Ag nanoparticles onto glassy carbon electrode for determination of cysteine | ماندانا امیری، پرستو سرایی |
| P48 | Electrochemical Determination of Antimony using Carbon Paste Electrode Modified with Carbon Nanotubes | مهشید پاداش، داریوش افضلی، علی مصطفوی، فریبا فتحی راد |
| P49 | Electrochemical Determination of Lorazepam in Pharmaceutical Tablets | شهلا مظفری، نعمت اله قنبری، ژولیت اردوخانیان |
| P50 | Electrochemical determination of oxalic acid using Pd doped mesoporous SBA-15 modified carbon paste electrode | وحید احساني، جهانبخش رئوف، فرشته چکین |
| P51 | Electrochemical Glucose Sensing Based on Nano-Sized Bisphenolic Ag Complex | نوید زندی آتشبار، حسین چینی فروشان، سارا بهمن پور خالصی، علی اصغر انصافی |
| P52 | Electrochemical Impedance Spectroscopy of Modified Graphite Electrode by Polypyrrole in Presence of Cr and Cu | مصطفی عابدینی، علی پارسا، علی مظلومی فر |
| P53 | Electrochemical oxidation of formic acid at palladium and tin modified palladium coated nanoporous gold film electrode | مریم مختاریان پور، ابوالفضل کیاني |
| P54 | Electrochemical Studies of Dopamine Based on Graphene Platelet Modified Electrode | سید مهدی قریشی، مبترا مرتضوی، اسما خوبی |
| P55 | Electrochemical studies of hydroxycholoroquine in biological fluids using multi wall carbon nano tube modified carbon paste electrode | سید مهدی قریشی، عطیه مقدم امین، اسما خوبی |
| P56 | Electrodeposition of Nickel oxide nanowires: Application for electrocatalytic determination of S2O8-2 | زبیده سواری جمالویی، سعید سلطانیان، عبداله نوربخش، عبداله سلیمی |
| P57 | Electrodeposition of silver thin films for electrochemical sensing of hydrogen peroxide | ماندانا امیری، یاشار عزیزیان کلاندرق، سیما نوحی |
| P58 | Electrosynthesis, characterization and electrocatalytic properties of Pt-Fe nanoparticles towards the oxidation of methanol | بیوک حبیبی، زهرا قربانی |
| P59 | Graphene-Manganase Oxide Nanocomposite for Prearation of Hydrogen Peroxidase Biosensore | خدیجه اسکندری، منیژه رمضانی، مهدی کمالی |
| P60 | Immobilization of glucose oxidase onto modifiedTio2 nanoparticles: direct electron transfer and electrocatalytic activity | نسیبه حقیقی، رحمان حلاج، عبدالله سلیمی |
| P61 | Influence of Hydrodynamic Conditions on the Corrosion Inhibition of St-37 Rotating Disc Electrode in Simulated Cooling Water Systems by Tartaric Acid (As a Green Inhibitor) | مریم قلی زاده خواجه، حبیب اشعثی سرخابی، الناز اصغری |
| P62 | Investigation of Electrochemical Behaviors of cathodic materials Lithium Iron Phosphate nanoparticles in LIB Batteries | فروزنده تعالي |
| P63 | Ionic liquid modified NiO/CNTs carbon paste electrode for simultaneous determination of morphine and diclofenac | افسانه لعل صنعتی، حسن کریمی مله |

## برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش سوم-
## پنجشنبه ۱۰:۳۰-۹:۵۰ با محور الکتروشیمی شیمی فیزیکی و تجزیه ای

| | | |
|---|---|---|
| P64 | Ivenstigation of Electrochemical Behavior of Nitrite Ion at the Surface of Different Electrodes | نوشین صفرزاده، حمزه آخوندی یامچی، سهراب ارشاد |
| P65 | Metal oxide nanoparticles/Conducting polymer Composite: Electrosynthesis and Characterisation | علي احساني، آمنه وزيري راد |
| P66 | Modified carbon paste electrode with nano composite of ZnFe2O4 and TiO2 as a sensor for de termination of acetaminophen | محبوبه رمضانی |
| P67 | Modified electrochemical sensor based on nanoparticles- imprinted sol-gel on the surface of pencil graphite electrode for sensitive determination of Papaverine | مولود حامدیان اصفهانی، علی اصغر انصافی، بهزاد رضائی |
| P68 | Nano electro copolymerization of aniline and 2,4-dinitrophenol in presence of potassium chloride and para toluene sulfonic acid | شیما احمدی، علی پارسا، لیلا حاجی آقا بابایی |
| P69 | Nano-Composite carbon paste electrode based on 2, 2'-Dithiobis (4-methylthiazole) for Lu3+ ion detection | فاطمه جزء یارمحمدی، حسنعلی زمانی |
| P70 | Nickel(II) selective membrane potentiometric sensor using dimethylglyoxime- clinoptilolite nanoparticles as an ionophore | مینا رضایی، علیرضا نظام زاده اژیه |
| P71 | Novel nano-composite modified carbon paste sensor for determination of lead (II) in hazardous wastes | علی شیرزادمهر، طیبه مدرکیان، عباس افخمی |
| P72 | Optimization of Ni electroless coating condition on ABS polymer surface | هادی گنج پرور، جمشید مفیدی |
| P73 | Ordered carbohydrate-derived porous carbons immobilized gold nanoparticles as a new electrode material for catalytic oxidation and determination of nicotinamide adenine dinucleotide | هادی حسینی |
| P74 | polymer/Zn nanocomposite as electrodes in supercapacitors | خدیجه دیده بان، هادی عادل خانی، مینا اکبری |
| P75 | Potentiometric investigation of-methylimidazole /2,6- dipicolinic acid proton transfer system and it's complexation with Zr4+and Nd3+ ions | اردشیر شکرالهی، سارا نصیری |
| P76 | Potentiometric sensor based on molecularly imprinting polymer for determination of Diclopenace in biological fluids | زهرا منصف، سمیه کشاورز ترک |
| P77 | Preparation of a carbon paste electrode based on Di-tert-butyl-1-(tert-butyl thio)-1,2-hydrazine dicarboxylate. | ملیحه سلطانی نژاد محمدی، حسنعلی زمانی |
| P78 | Simultaneous Determination of Tryptophan and Tyrosine Assisted by Chemometric Methods at the Surface of Gold Nanoparticles Modified Electrode | فائزه سعیدی نژاد، سید مهدی قریشی، سعید معصوم |
| P79 | Simultaneous Voltammetric Determination of Codeine (CO) and Acetaminophen (AC) Using a | عباس افخمی، حسین خوش سفر |

**برنامه زمانبندی پوسترهای نهمین سمینار سالانه الکتروشیمی ایران - بخش سوم-**

**پنجشنبه ۱۰:۳۰-۹:۵۰ با محور الکتروشیمی شیمی فیزیکی و تجزیه ای**

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| | Carbon Paste Electrode Modified with MgO Nanoparticle | |
| P80 | Simultaneous voltammetricdetermination of droxidopa and carbidopa using a carbon nanotubes paste electrode | هادی بیت الهی، سمیه تاجیک، محمدعلی طاهر، علی اکبری |
| p81 | Electrochemical Impedance Spectroscopy of Modified Graphite Electrode by Polyaniline in Presence of Cr and Cu | افسانه یاوری نسب افسانه یاوری نسب، علی پارسا، سوسن صمدی |
| | | |

**9th Iranian Annual Seminar of Electrochemistry**

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# Comparison of $MnO_2$ hydrothermal synthesis and electro deposition on graphene for super capacitor applications

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The specific pseudo-capacitance of metal oxides typically exceeds double layer Capacitance of carbon materials due to involving the faraday charge transfer reactions. Among all the metal oxides Manganese oxide is regarding as the most promising candidate material among the less expensive metal oxides to replace $RuO_2$ for pseudo capacitors. It is relatively low cost, low toxicity, and environmental friendly. At this work graphene oxide GO was synthesized according to Hummers' method and $Mno_2$ was synthesized by two various methods: reduction of $KMnO_4$ aqueous solutions with ethanol and manganese sulfate ($MnSO_4$) and ammonium per sulfate ($(NH4)_2S2O_4$) solutions reaction.

Dark brown Prepared $MnO_2$ mixed in various ratios (40%, 50% and 60%) to graphene (GO was reduced by hydrazine) paste then capacity was compared to $MnO_2$ that electro deposited on graphene. at the end it was characterized by use of cyclic voltammetry (CV), charge and discharge graph and impedance technique.

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthesis and Characterization of Pd and PdCo alloy nanocatalysts as an Alchol tolerant for Oxygen Reduction Reaction

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## Abstract

We report the use of binary carbon supports for fabricating membrane electrode assembly (MEA) of passive direct methanol fuel cells (PDMFCs) and their detailed electrochemical characterization. The binary-support electrode exhibits better performance than the single support electrode, and the best performance is obtained when the mass ratio of multi-walled carbon nanotubes (MWCNTs) and Vulcan XC-72R (VC) is 25:75. The results from the electrode kinetic parameters indicate that introduction of MWCNTs as a secondary support provides high accessible surface area, good electronic conductivity, and fast ORR kinetics. Surface area changes of Pd-based electrocatalysts supported on MWCNT were evaluated using an accelerated durability test (ADT). The results obtained using the ADT were correlated to the performance of the Pd-based electrocatalysts in the PDMFC. Finally, durability of electrodes was also examined in PDMFC and compared with that of the commercial Pt/C electrocatalyst.

**Keywords:** Oxygen electroreduction; $Pd_xCo$ bimetallic nanoparticles; PDMFCs.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Study of Composite Formation on Oxygen Reduction Reaction in Zinc-air Semi-Fuel Cell

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## Abstract:

Metal-air batteries or fuel cell typically use carbon based electrodes for electrochemical conversion. Graphene oxide (GO) can provides large accessible surface area therefore more ions can transport onto the material surface and achieving high electric-double-layer capacitance in aqueous electrolytes.

In this work two different types of GO/$MnO_2$ composite were synthesized and there electrochemical properties were compared. GO was synthesized by a modified Hummers method. One of composite was synthesized by electrostatic precipitation method (EPM), and another was synthesized by chemical treatment method (CTM). The syntheses of composites were confirmed by X-Ray diffraction and Scanning electron microscope. The electrochemical results reveal that EPM electrocatalyst performance is higher than that for CTM electrocatalyst. The LSV results showed that cathode current of electrode with EPM electrocatalyst was two times more than that for CTM electrode. Electrochemical impedance spectroscopy test results depicted that resistance of electrode with EPM electrocatalyst was half of CTM electrode resistance.

The batteries show 52 and 460 mAh/g, and 613.5 and 660 mAh/g, capacity on 5 and 2 mA discharge rates respectively. We can conclude that composite formation method affects its properties.

**Keywords**: Semi Fuel Cell, Graphene Oxide, Composite, Electrostatic Precipitation Method

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9th Iranian Annual Seminar of Electrochemistry4
4, 5 December 2013
University of Tarbiat Modares, Tehran, Iran

# Study of porosity of conducting polymers electrodes with using FFT admittance spectroscopy method for supercapacitor application.

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## Abstract

FFT admittance spectroscopy is a promising method of quality and comparable analysis of porosity of conducting polymer electrode. Research revealed that using differential admittance analysis, it is possible to observe how ions interact with polymer film during measurements and compare the quantity of out accessible porosity that exist in polymer film. By this method some parameter of polymer electrodes such as maximum potential of insersion of ions and times needed for reach to steady state of polymer electrodes was studied. In this work out accessible porosity of thick film polymer was studied. for example out accessible porosity for pani4 electrode is more three times than thin film polymer as pani1 electrode.

**Keywords**: **FFT Addmtance, Porosity, poly aniline, super capacitor.**

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthesis of Hard Carbon as Anode Material for Lithium-Ion Battery

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## Abstract

Hard carbon (HC) is one of the promising carbonaceous materials for energy storage in Li-ion batteries. Generally, HC is a kind of carbon that is difficult to be graphitized, and usually is prepared from pyrolysis of pitches and polymers. HC with the amorphous structure, compared with graphite, has higher capacity, lower cost, longer cycle life, better rate performance, and improved safety. In this work, a sample of pitch was cross-linked through nitric acid oxidation. For preparing HC, the oxidized pitch was then carbonized at 800°C under nitrogen atmosphere. XRD analysis demonstrated that the prepared HC has higher d-spacing and lower stacking height than graphite. Due to these features, the HC has higher capacity than the theoretically maximum capacity of 372mAhg$^{-1}$ for $C_6Li$ in the graphite. Electrochemical tests showed that the HC has 1260mAhg$^{-1}$ initial capacity for Li-ion storage, indicating the produced HC is suitable as anode material for Lithium-ion battery.

**Keywords:** hard carbon, lithium-ion battery, anode material, pitch

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Application of Anion Exchange Membrane in Electrochemical Energy Production Systems

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## Abstract

Electrochemical energy storage and conversion with high efficiency and cleanliness is unquestionably one challenge for the sustainable development of the society of human beings. The most common systems for electrochemical energy storage and conversion include fuel cells and batteries. In recent years, anion exchange membranes (AEMs) play important role in the performance improvement of the solid alkaline fuel cells and vanadium redox flow batteries. This membrane acts as solid polymeric electrolyte (instead of liquid electrolyte) and separator that is permeable to ionic (special anions) flow but preventing electric contact of electrodes. AEM consists of two important parts: polymer backbone and cationic functional group. The properties of each part have direct effect on the final efficiency of electrochemical system. Ionic conductivity, ion exchange capacity, ion transport number, water uptake and swelling degree are the most crucial parameters that should be optimized for AEM. Furthermore, AEMs should have desirable electrical, chemical, thermal and mechanical stability in alkaline media. Solid alkaline fuel cell is a new type of fuel cell that receives much attention in recent decade. This fuel cell has important advantages such as the use of metal catalysts on the electrodes with reasonable price, fast oxygen reduction reaction at the cathode, anode oxidation efficiency of liquid fuels, fuel selection flexibility and low corrosion. The AEM in this type of fuel cell is the electron barrier and suitable medium for carrying of hydroxide ion from cathode to anode. Vanadium redox flow battery is a secondary (rechargeable) battery that attracts the most attention due to its high-energy efficiency and a long cycle life. This battery consists of a solution of vanadium in sulphuric acid in both half cells. AEM transfers sulphate ions to keep electro neutrality in overall battery system. Finally, investigation of different AEMs with various characteristics can be useful to reach more reliable fuel cells and batteries in production of clean and renewable energy.

**Keywords:** Anion Exchange Membrane; Solid Alkaline Fuel Cell; Vanadium Redox Flow Battery

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**9th Iranian Annual Seminar of Electrochemistry**

**4 , 5 December 2013**

**University of Tarbiat Modares, Tehran, Iran**

# FacileOne-Step Strategy to Produce Platinum/Nitrogen Doped Graphene as high Performance Electrocatalyst for Direct oxygen Reduction and Anodic Fuel oxidation

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**In the present study a simple one stage strategy was used for preparing of N-doped graphene which decorated with Pt-nanoparticles using electrochemical procedure with graphite rod and Pt wires as electrodes and acetonitrile as solvent and nitrogen source reagent. In compared to commercial Pt-carbon ( 10% Pt), the prepared Pt/N-Gr nanocomposite not only shows excellent electrocatalytic activity and long durability toward oxygen reduction reaction (ORR) but also its electrocatalytic activity and stability toward oxidation of usual anodic fuels such as methanol, ethanol, hydrazine and formic acid is remarkably improved. In addition the poisoning and deactivation effects of fuels and their intermediate and oxidation products toward electrocatalytic activity of proposed electrocatalyst during long using time are negligible. The developed method in this study can be applied for preparation of Pt/N-Gr or other novel metal decorated N-Gr in large scale which used in different applications.**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthesis the Core-Shell Structure of Electrocatalyst and Investigation the performance of these for ORR in PEMFC

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## Abstract

Core–shell nanostructure is an effective way to increase the utilization efficiency of precious metal electrocatalysts. In this work, the core-shell Pt@Ru and Pt-Pd@Ru electrocatalyst were synthesis and compared the performance of these catalysts for ORR. For this mean, the 6 electrocatalysts with different atomic ratio of these catalysts were synthesis. First the Ru seeds deposited on carbon by using the impregnation method and heating under $H_2$ atmosfer and then the Pt and Pt-Pd were reduced on Ru/C by using the impregnation and hydrothermal method. The morphology of these catalysts was investigated by the XRD spectra and TEM images. The synthesized catalysts applied to GDE (Gas Diffusion Electrode) fabrication. The electrochemical activity of GDEs for ORR characterized with half-cell CV, LSV, Impedance spectroscopy and chronoamperometery tests. The results shows that the Pt-Pd@Ru with 2:1:3 for Pt:Pd:Ru atomic ratio. This result can be attributed to the structure of catalyst that can be increased the diffusion, adsorption and the rate of ORR on the GDE.

**Keywords:** core-shell, Electrocatalyst, ORR,PEM fuel cell, Pt, Ru, Pd.

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Evaluation of Non-Pt Cathode Catalyst in Alkaline Direct Borohydride Fuel Cell

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## Abstract

The objective of this study was to contribute to the development of the DBFC; a device that converts chemical energy stored in borohydride ion ($BH_4^-$) and an oxidant directly into electricity by redox processes. The single cell performance of non-platinum electrocatalyst as cathode was examined in alkaline electrolyte borohydride fuel cells. The influences of potassium hydroxide and sodium borohydride concentration were evaluation the performance of direct borohydride fuel cell which consisted of non Pt cathode. Furthermore, it was found that 10 wt. % of KOH concentration was optimum for DBFC operation in ambient condition. Analyzing the result of polarization curves, demonstrated that superior performance to that observed using 5% wt. of sodium borohydride for DBFC using non Pt catalyzed cathode in this media. Analysis of electrochemical impedance spectroscopy (EIS) in different potential for supplementary information showed not only low ohmic resistance but also small charge and mass transfer resistance.

Keyword: **Electrochemical impedance spectroscopy, Direct borohydride fuel cell, Non Pt Catalyst, Alkaline media**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013
University of Tarbiat Modares, Tehran, Iran

# Effect of Dispersion Solvent in Catalyst Ink on Proton Exchange Membrane Fuel Cell Performance

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## Abstract

Polymer electrolyte membrane fuel cells (PEMFCs) require nano particle platinum (Pt) catalysts to operate effectively at low temperature. In this study, nano particle of platinum coated on carbon support, solvent, and a binder agent were mixed to prepare catalyst ink.

The effect of dispersion solvent in catalyst ink performance of the membrane electrode assembly (MEA) for proton exchange membrane fuel cell is studied. Dispersion solvents under examination are Water: IPA and Isooctane: normal butyl acetate with dielectric constant 39.01 and 4.2 respectively.

MEAs were prepared by the direct catalyst-coated membrane (CCM) method in which the catalyst layers are coated directly on treated Nafion-115 membrane by spray; MEAs were assembled with gas diffusion electrodes.
MEAs are measured by linear sweep voltammetry (LSV) and electrochemical impedance spectroscopy (EIS). Electrochemical analyses revealed that the electrode prepared by using mixture of solvent NBA: isooctane with dielectric constant 4.2 showed higher catalyst utilization and better cell performance.

**Keywords**: Nano particle; PEMFC; MEA; CCM; Dielectric Constant.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013
University of Tarbiat Modares, Tehran, Iran

# Sensitization of Photoelectrochemical Solar Cells with a Natural Dye Extracted from Juglans Regia and Chamomile

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## Abstract

Dye sensitized solar cells (DSSCs) were fabricated using natural dyes extracted from Juglans Regia and Chamomile. To enhance performance of DSSCs based on natural dyes, we have devised efficient approach for extracting natural dyes including chlorophyll from *Juglans Regia* and *Chamomile*. The properties of extracted dyes have been investigated by UV-Vis technique. Solar cells sensitized by chlorophyll extracts from *chamomile* achieved up to $J_{SC}$ = 5.38 mA/cm$^2$ and $V_{OC}$ = 0.42 V, while for *Juglans Regia* the values determined were up to $J_{SC}$ = 1.28 mA/cm$^2$ and $V_{OC}$ = 0.32 V. The results obtained with extracts show a successful conversion of light into electricity by using natural dyes as sensitizers in DSSCs. It also represents an environmentally friendly alternative for DSSCs with low cost production and an excellent system for educational purposes.

**Keywords**
Dye Sensitized Solar Cells, Natural Dye, Nanostructured

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

Tehran, Iran University of Tarbiat Modares,

# Corrosion Inhibition of St-37 Rotating Disc Electrode in 3.5% NaCl Solution by L-valine-Disodium hydrogen phosphate System

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## Abstract

The use of inhibitors is one of the best options of protecting metals and alloys against corrosion. There is some evidences that mixtures of inhibiting compounds are more effective corrosion inhibitors than any of the constituents alone. In the present study, the inhibition effect of environmentally friendly compounds, L-valine and disodium hydrogen phosphate in controlling corrosion of St-37 steel in 3.5% NaCl solution has been evaluated by electrochemical impedance spectroscopy and potentiodynamic polarization measurements. Mixture of two compounds further reduced the corrosion current density and increased charge transfer resistance of metal. Formulation consisting of 5mM L-valine and 0.5mM disodium hydrogen phosphate has 72% inhibition efficiency in stagnant 3.5% NaCl solution, which is higher than individual efficiency of each inhibitor. The results indicated a synergistic effect between L-valine and disodium hydrogen phosphate. The inhibition efficiency was improved in hydrodynamic conditions and it reached to 95% at rotation rate of 2000 rpm.

**Keywords**

Corrosion, Rotating disc electrode, Synergism

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# The effect of chitosan added in electroless Ni-P-SiC plating solution on the properties of composite coatings

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## Abstract

Electroless Ni-P Composite coating have been widely used in many application fields for their unique combination of properties. Functional composite coatings can be easily obtained with highly specific properties by choosing the suitable particle. Ceramic particle, such as silicone carbide, are usually chosien to improve wear and corrosion behaviors. However, the electrolytes investigated have limitations, such as susceptibility to corrosion, low solubility of nickel, bath decomposition and the need for various additives. The effects of chitosan on the properties of electroless Ni-P-SiC deposit were investigated. Scanin Electron Microscopy and EDS were used to study of surface morphology, chemical composition of the coatings. Corrosion behavior of Ni-P-SiC and Ni-P-SiC-chitosan coatings were studied by electrochemical impedance spectroscopy (EIS) and Tafel polarization experiment in 3.5 wt.% NaCl solution. Results show existance of SiC nanoparticles and organice substances in the plating bath has enhanced coating properties such as increase of charge transfer insistance, reduce of corrosion current, causes to get more smooth surface and increases hardness.

**Keywords:** corrosion, Electroless plating, SiC nanoparticles, chitosan

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

Tehran, Iran University of Tarbiat Modares,

# Evaluationof Inhibitory Effect of Composition of Tannic acid and Phosphoric acid on Ancient Iron Object Based on electrochemical method

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## Abstract:

Nowadays, archeologists pay attention to protect of ancient metal objects to control corrosion. Applying electrochemical methods and its uniquemeasurement method, quick assessment of metal object corrosion has became possible in various environments. Using inhibitors to decrease corrosion is effective method to protect historical valuable objects. Therefore this method would be modern method of protection.In this research, it is attempted to provide nontoxic and secure inhibitor to protect ancient iron objects. Based on electrochemical methods in therefore, corrosion would be controlled and treated without any danger to whom renovate these objects and ancient object would not be affected. according to performed studies in developed countries, the composition of tannic acid and phosphoric acid is inhibitor to iron object and its inhibition effect had been evaluated using electrochemical methods). Findings show useful information about the effect of inhibitor. To continuance, the composition effectiveness had been studied to treat ancient objects.In this research, microscopic evaluation and electroanalysis device had been used. Fridings show inhibitory effect of tannic acid and $H_3PO_4$ to treat ancient iron objects.

**Keywords**:**Tannic acid; Phosphoric ; inhibitor**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical Study of Surface Energy and Dipole Charge of Metals

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## Abstract

The concept of the Fermi energy is a crucially important concept for the understanding of the electrical and thermal properties of solids. The contribution of surface energy(ω) and dipole charge(ϕ) in metals work function (WF) has been proved. On the other hand dependency of the WF with thickness has intensely been investigated by others theoretically and experimentally. So the WF as a key component of metal characteristic has been considered as an important sign of not only surface energy and dipole charge but also thickness.

In this research electrochemical technique is introduced as an suitable method to measure these parameters. Some metals (Zn, Pb, Co, Cu) with different WF were electrodeposited on the ITO for investigating. The potential of the ITO/metals with respect to an inert metal (Pt) in electrolytic media was considered as a rough approach for $E_F$ or the WF (similar to method of contact potential difference (CPD) employed to measure metal WF in physics field). Results showed that the measured WF and surface energy in electrolyte is in good agreement with those achieved from formula proposed by W. Missol in 1973.

$$\omega = \frac{1530}{q}\frac{WF}{M^{2/3}}(z\gamma)^{2/3} \quad (1)$$

In addition dipole charge was investigated for different thickness of metals. The calculations showed that the ϕ contribution to the electrostatic potential changes the dipole charge up to 300-800 meV for under consideration metals with different thickness. This will meet new applications in batteries, solar cells, sensors and diodes.

**Keywords:** surface energy,dipole charge,metal work function

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Catalytic Electrosynthesis of Nanostructured Conducting Polypyrrole on Copper Interdigital Electrodes by Passivation

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## Abstract

Direct electrodeposition of conducting polymers on active metals such as copper is complicated because metal oxidation that occurs at the positive potentials required for polymer formation. Therefore, conducting polypyrrole (PPy) films were prepared on the surface and spacing between copper interdigital electrodes (Cu-IDEs) in two steps. In the first step, surface of Cu – IDEs coated by pre-electropolymerization with the presence of 0.1 M pyrrole and 0.2 M oxalate as primary anion dopant in aqueous solution (passivation layer) . After the pre-electropolymerization step, the modified IDE was transferred into a mixture of 0.1 M pyrrole and 0.05 M of a transition-metal salt as catalyst, in which the PPy was coated between the modified IDE under the control potential conditions. The effects of the transition metal ion ($Fe^{2+}$, $Co^{2+}$, $Ni^{2+}$, $Cu^{2+}$, $Zn^{2+}$) on the morphology and conductivity of PPy films were also studied. SEM has confirmed the nano-structure morphology of the films.

**Keywords:** Passivation; Conducting Polymer; Active Metals; Electrosynthesis; Catalyst

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A Simple Method for Electrochemical Synthesis of Coordination Polymer Coatings on Metallic Substrates

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## Abstract

Coordination polymers (CPs) have different technical applications in catalysis, gas storage, magnetism, ion exchange and optics [1]. This work focused on electrochemical method as an effective and versatile means of growing functional CPs and on trying to develop facile method for interfacing CPs with surfaces. In this way, electrochemical synthesis of two Cu (II) based CPs, $[Cu_2(2,2'\text{-thiodiacetate})]_n$ and $Cu_2(1,2,4,5\text{-benzen-tetra-carboxylate})(H2O)_4,8H_2O]_n$ have been investigated. These syntheses were accomplished by fairly slow oxidation of a copper plate in an aqueous solution containing a ligand and 0.1 M $NaNO_3$. As the Cu (II) ions were produced in the vicinity of the plate, the CP structure can be formed and grew at the surface of it. At the end of the process a layer of CP coating has been formed at Cu plate. The produced CP coatings were characterized by scanning electron microscopy, X-ray diffraction, elemental analysis and thermal gravimetric and differential thermal analyses.

**Keywords: 2,2'-Thiodiacetic; 1,2,4,5-Benzen tetra carboxylic acid; Coordination polymer; Electrochemical synthesis**.

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9th Iranian Annual Seminar of Electrochemistry
4 , 5 December 2013
University of Tarbiat Modares, Tehran, Iran

# The electrochemical synthesis of new indoyl-phthalazines derivatives

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## Abstract

Phthalazines have attracted scientific interest because of their biological properties, clinical therapeutics and pharmacology [1-5]. On the other hand, indole derivatives are important therapeutic agents in medicinal chemistry including anticancer [6], antioxidant [7], and also play a vital role in the immune system [8]. In this direction, the electrochemical oxidation of 2,3-dihydrophthalazine-1,4-dione has been studied in the presence of indole and 2-methylindole as nucleophiles in a water/acetonitrile (70/30) mixture by means of cyclic voltammetry and controlled-potential coulometry. Our voltammetric data indicate that electrochemically generated phthalazine-1,4-dione participates in Michael type addition reaction with indole derivatives and via an *EC* mechanism converts to the new indoyl- phthalazine derivatives as final products. Clean synthesis, the use of electricity instead of chemical reagents, and the achievement of high atom economy via a one step process conducted under ambient conditions are of preeminent green advantages.

**Keywords:** 2,3-Dihydrophthalazine-1,4-dione; Electrochemical synthesis; Indole.

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# The potential of electrochemical processes in petrochemical industry

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**Abstract**

The first electrochemical reaction that well known in the petrochemical industry, is chlorine production in chloro-alkali units. The different technology and their developments has been distinguished completely. The electrochemical synthesis of organic material and polymers are another field of electrochemical process that there is not enough understanding of it in Iran. These processes can be controlled by use of current or voltage. The main principal of industry electro synthesis and the regular electro synthesis is reported in this research. Using of solid oxide fuel cell for syn gas production is one of subjects in this research. Syn gas is a main feed for petrochemical industries. The treatment of petrochemical waste water by use of electrochemical methods is another subject that has been explained completely. The electrochemical methods for recovery of catalyst that have been used in petrochemical processes have been distinguished.

**Keywords:** electrochemistry, petrochemical industry, electrosynthesis, fuel cell. Chloroalkali, waste water treatment

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Investigation Mixed surfactant system for dispersion of multiwalled carbon nanotubes(MWNTs)

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## Abstract:

Multiwalled carbon nanotubes (MWNTs) show some tremendous
set of properties, including high moduli of elasticity, high aspect ratios, and optical and magnetic properties. Their high aspect ratios cause them to entangle and form bundles. Carbon nanotubes have high Vander Waals interaction which causes a strong bundling of carbon nanotubes. A wide variety of surfactants have been investigated to date for dispersion of carbon nanotubes.

In this work, the synergistic effect of surfactants on dispersion of carbon nanotubes was investigated. The binary mixture of ester quat and sodium dodecyl sulphate was used with the ratio of 90/10 respectively. The obtained results of uv-vis spectrophotometry shows that the nanotube dispersion occurs in a lower concentration in mixed surfactants compared to the pure ones. Additionally, the Raman results indicate that the nanotubes structure is not changed during the dispersion process meaning that the surfactants adsorption on nanotube surface is of the physisorption kind.

**Key word: Dispersion, MWCNTs,Surfactant, synergistic**

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Electrodeposition of Graphene Film on Indium Thin Oxide Regarding Water Base Solution; a Mechanism Study

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## Abstract

Graphene nanosheets, a new two-dimensional (2D) structure consists of $sp^2$ hybridized carbon atoms, have attracted great attention since experimentally produced in 2004. In this research we survey electrochemically reduced graphene oxide by cyclic voltammetry method afterwards the conversion mechanism of graphene formation regarding pH, solution conductivity and potential – current criteria are evaluated. Film resistances are monitored by Electrochemical Impedance Spectroscopy (EIS), Differential Pulse Voltammetry (DPV) and Sweep Linear Voltammetry (SLV) as a probing electrode in a water dispersed graphene oxide solution. Eventually the features of the optimized graphene thin film were characterized by XRD, FT-IR and Raman spectroscopy. Results represented the best reduction state can be take place in pH=11.5, and solution conductivity of 2320 $S.cm^{-1}$ which this minimizing indeed carried out by DPV and SLV methods. Thoroughly removing of functional group in the range of 1000-1500 FT-IR and shifting of Raman spectra and XRD respectively confirm an efficient reduction.

**Keywords: Graphene, Electrochemical reduction, Mechanism**

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9th Iranian Annual Seminar of Electrochemistry
4 , 5 December 2013
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# Metalic Nanoparticles Embeded in Ionic Liquid Derived Ordered Mesoporous Carbon: Electrocatalytic Performance toward Oxygen Reduction Reaction

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## Abstract

Oxygen Reduction Reaction (ORR) is known as one of the bottlenecks of the industrial development of fuel cells.[1] Developing the efficient and cost effective catalytic materials for this reaction has found considerable attention during the past two decades. Pt based cathode materials exhibited the best electrocatalytic activity and minimum reported over-voltage for ORR. However, Pt based electrocatalysts suffer from the expensive cost of the Pt and several attempts have been performed for lessening the cost of electrocatalyst of ORR. In achieving this goal supporting of Pt on low-priced conductive materials was the most successful route. One of the most attractive and successful supports was the Ordered Mesoporous Carbon (OMC) and a wide variety of methodologies have been developed to incorporate the Pt within these nanostructured carbon frameworks. Among them, N-doped carbons have received considerable attentions due to the electron donor nature of N that even improve the catalytic performances of Pt toward ORR.[2] Herein a novel nitrogen-doped Ionic Liquid derived OMC (IOMC) has been employed as the support of Pt for ORR. The desired IOMC were conveniently made by the carbonization of guanine dissolved in an ionic liquid 1-Methyl-3-phenethyl-1H-imidazolium hydrogen Sulfate using hard templating with SBA-15.[3] This process yields high surface-area nitrogen-doped carbon materials and narrow mesopore size distribution. The Pt nanoparticles were incorporated by impregnation of $PtCl_6^{2-}$ followed by chemical reduction using $NaBH_4$. The embeded nanoparticles and strycture of the support were charactrized by TEM and $N_2$ adsorption analyses. The desired electrocatalyst has shown very good electrocatalytic activity and low over-voltage comparing to the previously reports nitrogen-less OMCs.

## Keywords

Ordered mesoporous carbon, Platinum nanoparticle, Oxygen Reduction Reaction

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Potentiometric investigation of 2,5 pyridine dicarboxylic acid-piperazine proton-transfer system and it's complexes with some metal ions

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**Abstract**

In this study, protonation constants of 2,5 pyridine dicarboxylic acid(2,5-pydc), piperazine (pipz), stability constants of proton transfer system of 2,5pydc/pipz and it's complexes with $Cd^{2+}$, $Ni^{2+}$ and $Zn^{2+}$ ions has been calculated by potentiometric-pH metry titration method. All steps of titrations carried out at 25.0±0.1 ˚C and I=0.1 M $NaNO_3$. Ligands' protonation constants and stability constants of proton transfer and their metal complexes were evaluated by computer refinement of the pH-Volume titration data using the BEST computer program. The distribution diagram of all systems as a function of pH was depicted by using Hyss 2009 program. The most likely species were obtained from distribution diagrams. The results was comparied with spectroscopy information in solid state.

**Keywords**:**2,5pyridinedicarboxylicacid, piperazine, protonationconstants**

Proton transfer systems between some pyridine dicarboxylic acids and bases piperazine were considered [1,2,3]. Although the protonation and complexation of 2,5 pyridine dicarboxylic acid with proton and several metal ions have been investigated in literature[4], but there isn't any report about its proton transfer with bases in solution. In this study, protonation constants of 2,5-pydc, pipz, stability constants of proton transfer system of 2,5pydc/pipz and it's complexes with $Cd^{2+}$, $Ni^{2+}$ and $Zn^{2+}$ ions has been calculated. Several models were tested and the best one which accepted by the least sum-of-squared deviation were chosen. It is interesting to note that the stoichiometries of the some of the most abundant ternary complexes existing in solution, are very similar to those reported for the corresponding isolated complexes in the solid state.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of TarbiatModares,Tehran, Iran

# Au /PAMAM-Dendrimer functionalized wired ethyleneamine-viologen as highly efficient interface for ultra-sensitive AFP electrochemical immunosensor

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**Abstract**

In this work, a novel electrochemical immunoassay system is developed for ultrasensitive detection of cancer biomarker, α-fetoprotein (AFP). This immunosensor is constructed by covalent immobilization of polyamidoamine (PAMAM) dendrimer-encapsulated gold nanoparticles (Au-PAMAM) sensing interface on a Au electrode surface, followed by sequential covalent immobilization of ethyleneamineviologen (Vio) electrochemical redox marker and AFP monoclonal antibody (mAb) on the surface of Au-PAMAM via phtaloyl chloride (Pht) as linking agent. Upon the immunorecognition of the immobilized AFP to its antibody, the peak current arisen from Vio decreased due to the hindered electron transfer reaction on the electrode surface. Through the differential pulse voltammetry (CV) and electrochemical impedance spectroscopy (EIS) experiments, it is found that the proposed method could detect AFP antigen with a linear range of 0.001 ng $mL^{-1}$ to 45 ng $mL^{-1}$ and a detection limit down to 0.3 pg $mL^{-1}$. Moreover, the fabricated Au-PAMAM-based immunosensor could accurately detect AFP concentration in human serum samples demonstrated by excellent correlations with standard ELISA immunoassay.

**Keywords**:Immunoassay,α-fetoprotein (AFP),Gold nanoparticles,Dendrimer

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Gold Nanocages Decorated on Graphene as Electrocatalyst for Borohydride Oxidation

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## Abstract

Gold nanocages were prepared by galvanic replacement reaction between sacrificial silver nanocubes (AgNcube) and $AuCl_4^-$ ions. Also, graphene nanosheets (G) were synthesized. Then, the prepared AuNcage were decorated on the as-prepared graphene (AuNcage/G). Morphology and chemical composition of the prepared nanocomposite were studied by scanning electron microscopy (SEM) and energy dispersive X-ray (EDX), respectively. The glassy carbon electrode (GC) was modified by as-prepared nanocomposite and borohydride electrooxidation was investigated at its surface. The prepared nanocomposite showed good electrocatalytic behavior toward the borohydride oxidation. For comparison, the borohydride electrooxidation was studied at the GC electrode modified by Ag nanocube decorated on graphene (AgNcube/G). Studies revealed that AuNcage/G showed superior electrocatalytic activity toward the borohydride electrooxidation compared to AgNcube/G.

**Keywords**

Gold nanocages, Graphene, Borohydride electrooxidation, Ag nanocube, SEM, EDX.

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Glassy carbon electrode modified with graphene oxide nano-sheets and nano-structured FeHCF and its applications in electrochemical sensors

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**Abstract**

A new strategy for formation of a robust and stable film comprising prussian blue nanoparticles (PBNPs) by means of self-assembly on glassy carbon electrode modified with graphene oxide nano-sheets has been introduced **Figure 1**. All of the preparation steps and analytical application conditions were optimized. The cyclic voltammograms of the modified electrode showed a well-defined pair of redox peaks due to FeHCF system **Figure 2**. The calculated values of α and $k_s$ for the redox pairs were 0.55 and 3.1$s^{-1}$, respectively. The modified electrode showed high electrocatalytic activity toward hydrogen peroxide reduction **Figure 2**. The calibration curve for Hydrodynamic Amperometric hydrogen peroxide determination was linear over 3.5 nM – 400 µM (Y=0.27x -1.34E-6 $R^2$=0.996).

**Keywords:** Electrochemical sensors; Graphene oxide nano-sheets; Prussian Blue nanoparticles; Hydrogen peroxide;

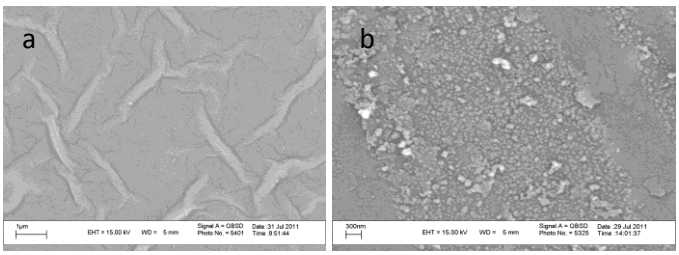


**Figure 1** SEM images of graphene oxide (a) and self assembled Prussian blue nano particles on surface of graphene oxide (b).

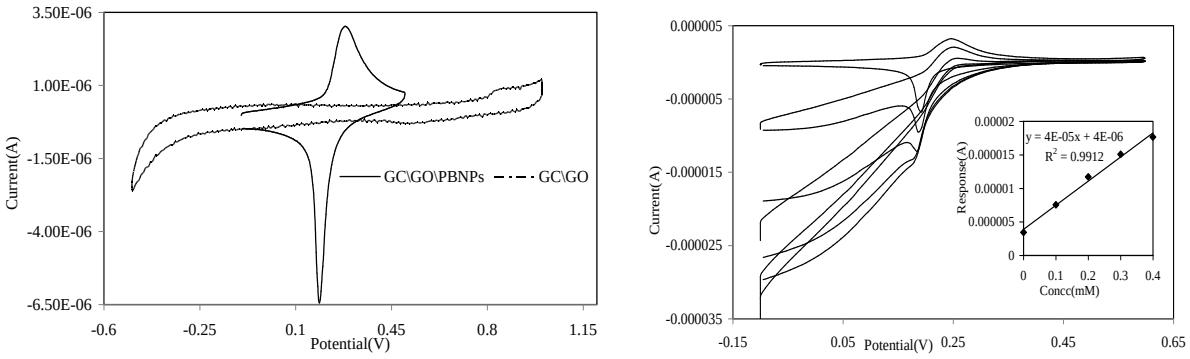


**Figure 2.** Cyclic voltametric performance of GC\GO\PBNPs modified electrode and GC\GO e in 10mL 0.1 M KCl and 0.05 M PBS, pH= 6 at 50 $mVs^{-1}$ scan rate.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Voltammetric determination of acetaminophen using carbon paste electrode modified by sulfonate carbon nanopartilce

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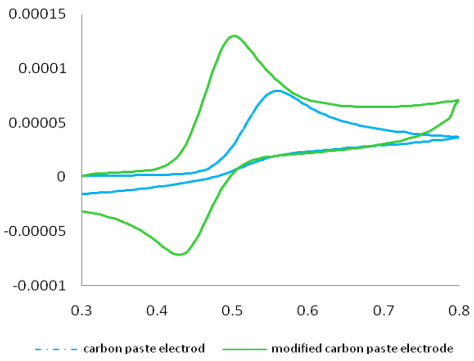
## Abstract

Today, the carbon nano-materials have found a great attention. Carbon nanostructures are very interesting for applications such as sensing and energy storage. In this research, the carbon paste electrode was modified with sulfonate carbon nanoparticles (CNPs) for determination of acetaminophen (AC). AC is a popular, antipyretic and non-steroidal anti-inflammatory drug.

The modified electrode has been shown an excellent performance in electrocatalytic activity, sensitivity toward acetaminophen. The CNPs have large surface area and ability to increase the rate of electron transfer. The effect of some parameters such as pH and scan rate was studied in voltammetric response. Differential pulse voltammetry (DPV) was used for quantitative determiation of acetaminophen. A dynamic linear range was obtained in the range of $1.0\times10^{-7}$-$1.0\times10^{-3}$mol $L^{-1}$.The modified electrode shows several advantages such as decreasing over voltage, simple preparation method, long-time stability, ease of preparation and regeneration of the electrode surface by simple polishing and excellent reproducibility. The carbon paste modified by sulfonate carbon nanoparticles has been applied for determination of acetaminophen in commercial samples successfully.




**Keywords:** carbon nanoparticles; carbon paste; acetaminophen; voltammetric sensor

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Nanostructured base electrochemical sensor for determination of isoproterenol

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## Abstract

The subtle electronic behavior of carbon nanotubes reveals that they have the ability to promote electron-transfer reactions when used as an electrode material in electrochemical reactions. In recent years, considerable efforts have been made to fabricate different CNT morphologies and explore their application in various fields including composites, electrochemical devices and sensors [1]. Isoproterenol is widely used for the treatment of primary pulmonary hypertension and allergic emergencies, status asthmaticus, bronchial asthma, ventricular bradycardia, cardiac arrest, and glaucoma [2]. It is also used to bronchitis, cardiac shock and heart attack [2]. In this study, a carbon paste electrode modified with 5-amino-2'-ethyl -biphenyl-2-ol and carbon nanotubes was used to prepare a novel electrochemical sensor for the detection of isoproterenol. Under the optimum pH, the oxidation of isoproterenol occurs at a potential about 270 mV less positive than that of the unmodified CPE. The present method was applied to the determination of isoproterenol in real samples.

**Keywords:** Isoproterenol; Carbon nanotubes; Electrocatalysis; Chemically Modified electrode

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Optimization and Evaluation of Electrochemical Generation of Volatile Silver and Copper Hydrides by QTA-AAS

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**Abstract**

As a suitable alternative approach to chemical hydride generation (HG) techniques, electrochemical HG (ECHG) has been used as a sample introduction method for spectrometric determination of Hg and hydride forming elements (HFEs), such as, As, Bi, Cd, Ge, Pb, Sb, Se, Sn, Te, Tl and Zn because of its advantages. It would be challenging and interesting to expand the ECHG to other HFEs.

In this work, electrolytic HG system coupled to an electrically-heated quartz tube atomic absorption spectrometry (QTA-AAS) has been developed and optimized for determination of trace amounts of Ag and Cu in aqueous solutions. A laboratory-made semi-batch cell with Pb-Sn cathode was used as hydride generator based on the electrolytic reduction of Ag and Cu ions to their unstable volatile molecular species. Scanning electron microscopic (SEM) analysis has been used to study the mechanism of hydride generation from the cathode surface. The method is based on the reaction between electrochemically generated hydrogen atoms on the cathode surface of electrolytic cell and the deposited elements. The influence of the experimental parameters on the analytical response was studied. Under the optimized conditions, the calibration curve was linear in the range of 3-200 ng $mL^{-1}$ of Ag. A concentration detection limit ($3\sigma_b$, n=6) of 1.2 ng $mL^{-1}$ Ag and a relative standard deviation of 3.2% (RSD, n=8) for 100 ng $mL^{-1}$ Ag were obtained. the detection limit ($3\sigma_b$, n=3) was found to be 0.3 mg $L^{-1}$ Cu and the RSD for six replicate analyses of 10 mg $L^{-1}$ Cu was 4.3%. The calibration curve was linear in the range of 5-100 mg $L^{-1}$ of Cu. The potential interferences from various ions were also evaluated. Although the achieved detection limit is poor for Cu; however the proposed procedure is rapid, relatively simple, low cost and sensitive especially for Ag.

**Keywords:** Electrochemical hydride generation; Atomic absorption spectrometry; Silver; Copper

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# Voltammetry studies and determination of Buprenorphine in urine samples by carbon paste electrode modified with sodium dodecyl sulfate

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## Abstract

**In the present study, the electrochemical behavior of carbon paste electrode modified by sodium dodecyl sulfate (SDS) and then application of this electrode for oxidation of buprenorphine (BPR) was evaluated. The results of the present study demonstrated that SDS causes several fold increase in the peak current and decrease in detection limit. The impedance spectroscopy was used for study of SDS effect on carbon paste electrode that a decrease in the charge transfer resistance ($R_{ct}$) could result that electrode modified by SDS. In the last part the modified electrode had been used to the determination of BPR in urine and drug samples.**

***Keyword*: Buprenorphine, Sodium dodecyl sulfate, Carbon paste electrode, Differential pulse voltammetry**

9th Iranian Annual Seminar of Electrochemistry

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University of Tarbiat Modares, Tehran, Iran

# Electrosynthesis of Pt-Co alloy nanoparticles and its electrocatalytic activity towards the ethanol oxidation in acidic media

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## Abstract

The electrooxidation of ethanol was investigated in acidic media on the platinum-cobalt alloy carbon-ceramic modified electrode (Pt-Co/CCE) via cyclic voltammetric analysis in the mixed 0.5 M ethanol and 0.1 M $H_2SO_4$ solutions. The Pt-Co/CCE catalyst, which has excellent electrocatalytic activity for ethanol oxidation than the Pt nanoparticles carbon-ceramic modified electrode (Pt/CCE) and smooth Pt electrode, shows great potential as less expensive electrocatalyst for these fuels oxidation. These results showed that the presence of Co in the structure of catalyst and application of CCE as a substrate greatly enhance the electrocatalytic activity of Pt towards the oxidation of ethanol. Moreover, the presence of Co contributes to reduce the amount of Pt in the anodic material of direct ethanol fuel cells, which remains one of the challenges to make the technology of direct ethanol fuel cells possible. On the other hand, the Pt-Co/CCE catalyst has satisfactory stability and reproducibility for electrooxidation of ethanol when stored in ambient conditions or continues cycling making it more attractive for fuel cell applications.

**Keywords:** Electrosynthesis, Pt-Co alloy, Ethanol oxidation, Carbon-ceramic electrode

# Electrocatalytic reduction of carbon dioxide by a dinuclear Rhenium (I) complex [Re Cl (CO) $_3$ (μ-tptzH) Re (CO) $_3$]

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## Abstract

The development of molecular systems for the conversion of $CO_2$ to energetically molecules represents an important technological and environmental challenge due to the abundance of $CO_2$ in the atmosphere that contributes significantly to the greenhouse effect. The dinuclear Rhenium (I) complex was used as a homogeneous and heterogeneous catalyst for the electrochemical $CO_2$ reduction. The homogenous effect of complex was investigated in $CO_2$-saturated DMF solution and for investigating of heterogeneous effect, the complex was deposited on pencil graphite electrode in $CO_2$-saturated methanol solution. Also addition of acid enhances the rate of the catalytic process and reduces the onset potential of $CO_2$ reduction. The surface of PGE was modified by carboxylated multi wall carbon nano tubes that cause to increase the surface and current of $CO_2$ electro reduction. All results of $CO_2$ reduction were studied by cyclic voltammetry (CV) technique and they showed that the complex exhibited electrocatalytic activity for the reduction of $CO_2$ to CO and format products.

**Keyword:** Carbon dioxide, Electrocatalyst, Electrochemical reduction, Rehnium complex

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# Impedimetric and Stripping Voltammetric Determination of Methamphetamine at Gold Nanoparticles and Multiwalled Carbon Nanotubes Modified Screen Printed Electrode

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Methamphetamine (MA) is used to treat obesity and alcoholism, but it causes some physiological and psychological effects such as increased heart rate and blood pressure, affecting body temperature, attention and mood [1, 2].

A high performance electrochemical sensor for the detection of methamphetamine (MA) at the gold nanoparticle (GNP)/multiwalled carbon nanotube (MWCNT) modified screen printed electrode (SPE) is reported. GNPs were electrodeposited on the substrate using a constant potential. EDX spectrum and mapping and also SEM results showed that GNPs were deposited and dispersed uniformly on the SPE/MWCNTs, respectively. The electrochemical behavior of MA was studied by CV, and modified electrode was used for the determination of sub-nanomolar amounts of MA in samples using square wave stripping voltammetry (SWSV) and electrochemical impedance spectroscopy (EIS). Under the optimized experimental conditions, the modified SPE revealed broad linear ranges of 0.02–0.1 and 3.0–50 µM (LOD = 6 nM) for SWSV and 1.15–26.9 nM (LOD = 0.3 nM) for EIS. Finally, the SPE/MWCNTs/GNPs showed stable electrochemical cyclic voltammetry responses. Moreover, using sensitive methods like impedimetric and stripping results in excellent responses.

**Keywords:** Methamphetamine; Impedimetric Sensor; Anodic Stripping Voltammetry; Gold Nanoparticles; Screen Printed Electrode; MWCNTs

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# Developing of a highly sensitive biosensor for determination of phenolic compounds

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## Abstract

In this work we developed a very sensitive biosensor for determination of important phenolic compounds such as dopamine, acetaminophen and catechol. The sensor was designed by immobilizing horse radish peroxidase(HRP) in a sol-gel and carbon nano tube matrix on to glassy carbon electrode. HRP can be activated in the presence of $H_2O_2$ then activated HRP oxidized phenolic compound and finally oxidized phenolic compound can be reduced on glassy carbon electrode. The direct electron transfer between activated HRP and electrode can be avoided by use of the sol–gel matrix. So the amperometric response of biosensor will be exactly proportional to phenolic compound concentration. Biosensor showed a linearly response for determination of dopamine, acetaminophen and catechol in a wide range of concentration. Parameters of biosensor fabrication were optimized and experimental conditions influencing the biosensor performance such as pH and scan rate potential were investigated. Biosensor response was suitably stable after 20 days.

**Keywords: biosensor; horse radish peroxidase; sol gel;carbon nanotube; phenolic compounds.**

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# Determination of ascorbic acid using carbon-paste electrode modified with clinoptilolite nano-particles containing hexadecyltrimethylammoniumbromide surfactant

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**Abstract**

A new method was developed for the catalytic oxidation of ascorbic acid (AA) in aqueous solutions at carbon-paste electrodes modified with clinoptilolite nano-particles containing hexadecyltrimethylammonium bromide (HDTMA-Br) surfactant. The modified electrode showed excellent electrocatalytic activity for oxidation of AA. The measurements were carried out by application of the cyclic voltammetry, square wave voltammetry and chronoamperometry methods. The modified electrode lowered the overpotential of the reaction by ~350 mV. The effects of several parameters such as pH, particle size of zeolite, kind and concentration of supporting electrolyte and potential scan rate were investigated. The cyclic voltammetric, square wave voltammetric, and chronoamperometry response of the electrode to ascorbic acid was linear in the range of $4.5\times10^{-9}$- $3.2\times10^{-1}$ M, $1\times10^{-2}$- $1\times10^{-10}$ M, $1\times10^{-2}$- $1\times10^{-10}$ M of AA with a detection limit of $3.3\times10^{-9}$ M, $6.1\times10^{-10}$ M, $5.9\times10^{-10}$ M, respectively. The diffusion coefficient of ascorbic acid was equal to $4.09\times10^{-5}$ $cm^2$ $s^{-1}$. The proposed method was successfully applied for determination of AA in pharmaceutical and real samples such as: Chewable tablet, Vitamin C tablet, Orange juice, Sour lemon juice, Sweet lemon juice, Lemonades.

**Keywords**: *Zeolite modified electrode,* Ascorbic acid, Nanoparticles, Clinoptilolite

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# Thermodynamic study of the ($CaCl_2$+alanine+water) system using modified nanotube sensor

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## Abstract

Recently, thermodynamic study of aqueous multicomponent electrolyte solutions has been a growing interest because of their importance in areas such as chemistry, biology, process engineering, desalination and atmospheric processes. In this study, the results relating to the thermodynamic properties of ($CaCl_2$+alanine+water) system using the potentiometric method are reported. The electromotive force measurements were performed on the galvanic cell of the type: Ag|AgCl|$CaCl_2$ (m), alanine ($m_A$), water|Ca-ISE, in various mixed solvent systems containing 0, 0.1 and 0.2 molal of alanine over ionic strength ranging from 0.0010 to 4.0000 mol.kg$^{-1}$ at T=(298.2 and 303.2) K. The Ca-ISE was prepared using the ionophor treated by carbon nanotubes. The Debye-Hückel extended equation, Pitzer ion interaction and PSC models was used for experimental data correlation and calculation of thermodynamic properties such as the mean activity coefficients, the osmotic coefficients and the excess Gibbs free energy for electrolyte solutions.

### Keywords

Thermodynamic study, Mixed solvent system, Potentiometric method, Nanotube sensor

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Fabrication of High Performance Bioanode based on Fruitful Association of Dendrimer and Carbon nanotube used for design $O_2$/Glucose Membrane-less Biofuelcell with Improved Bilirubine Oxidase Biocathode

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## Abstract

Enzymatic biofuel cells provide a safe and renewable means of powering small electronic devices. These bioelectronic devices utilize enzymes as biocatalysts at one or both electrodes. So enzyme-modified electrodes are core components of enzymatic biofuel cell. In this study, the preparation of an integrated modified electrode based on the covalent attachment of glucose dehydrogenase enzyme and safraninO to amine-derivative multi walled carbon nanotubes modified glassy carbon electrode using G2.5-carboxylated PAMAM dendrimer as linking agent is reported. The proposed system has effective bioelectrocatalytic activity toward glucose oxidation at100mV with onset potential of −130mV (vs.Ag/ AgCl). The performance of the prepared hybrid system of GC/MWCNTs-$NH_2$/Den/GDH/Safranin as anode in a membraneless enzyme-based glucose/$O_2$ biofuel cell is further evaluated. The biocathode in this system was composed of bilirubin oxidase enzyme immobilized onto a bilirubin modified carbon nanotube GC electrode. Immobilized BOX onto CNTs/bilirubin not only shows direct electron transfer but also it has excellent electrocatalytic activity toward oxygen reduction at a positive potential of 610mV. The open circuit voltage of the cell was 590mV. The maximum current density was 0.5mAcm$^{-2}$, while maximum power density of 108 μWcm$^{-2}$ was achieved at voltage of 330mV. The output power of the BFC is approximately constant after12h continue operation.

**Keywords:** biofuel cell, membraneless, dendrimer, MWCNT

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4, 5 December 2013

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# Voltammetric Study on Chemically Synthesized Palladium Nanoclusters

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## Abstract

In this research, it was trying to chemically synthesize of Palladium thiolate nanoclusters in the colloid phase, to purify and to separate and isolate the smallest partial nanometric part of Palladium-Octanethiolated (Pd-C8SH) core-shell nanoclusters, so called Monolayer Protected Clusters (MPC) by solvent fractionation. Then, the electrochemical behaviour of nanometric MPCs has been explored.Quantized Capacitance Charging of Pd Clusters has been frequently observed which confirms the nanometric size of as-prepared nanoclusters.Finally, the nanoclusters additionally characterized by DPV, SEM and IR. The frequent peaks in CV arise from successive, quantized (single-electron) capacitative charging of ensembles of individual cluster cores (i.e., electrochemical ensemble Coulomb staircase charging). The charging of clusters with very small cores becomes redox molecule like, indicating the emergence of HOMO-LUMO energy gaps. In this regime of nanoparticle voltammetry, the MPCs behave as quantum capacitors.It means that the MPCs behave as multivalent redox species during charge transfer at nanoscale as the injection of charge to the cores is quantized. Because the quantized charging currents of the clusters are diffusion controlled, their voltammetric behavior is proportional with their size.

**Keywords:** Palladium MPC, Electrochemical Characterization

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4 , 5 December 2013

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# CdS/$TiO_2$/Graphene Nanocomposite Photoanode for Enhanced Photoelectrochemical Performance

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## Abstract

Hydrogen is one of candidates for replacing fossil fuels that can be produced from water splitting via photoelectrochemical (PEC) process using solar energy. Also, Graphene with high conductivity, electron mobility, chemical stability and specific surface area is very attractive for PEC applications. In this research, several systems including $TiO_2$, CdS/Ti, CdS/$TiO_2$/Ti, CdS/Graphene/Ti, $TiO_2$/Graphene/Ti, CdS/$TiO_2$/Graphene are synthesized by sol-gel and successive ion layer adsorption and reaction (SILAR) process. SEM, EDX and XPS are employed to characterize the corresponding systems. Photocurrent density generated in the process is used as a measure for comparing their PEC performance. Based on our data analysis, the CdS/$TiO_2$/Graphene photoanode achieved about 4 A/$m^2$ that is higher than the synthesized single and binary nanocomposite photoanodes. High specific surface area of Graphene as well as the multistep electron transfer mechanism is believed to be responsible for this enhancement.

**Keywords**
Graphene based nanocomposite, PEC performance, Electron transport

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Simultaneous determination of isoproterenol, acetaminophen and tryptophan using a nanocomposite-based electrochemical sensor

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## Abstract

In this study we describe, the electrooxidation of isoproterenol (ISPT), acetaminophen (AC) and tryptophan (Trp) and their mixture has been studied using an 8,9-dihydroxy-7-methyl-12H-benzothiazolo[2,3-b]quinazolin-12-one modified multiwall carbon nanotubes paste electrode (DMBQ-MCNTPE). The novel sensor exhibited potent and persistent electron mediating behavior followed by well separated oxidation peaks towards ISPT, AC and Trp with activation over-potential. The peak currents were linearly dependent on ISPT, AC and Trp concentrations using square wave voltammetry (SWV) method in the range of 0.04–400, 5.0–500, and 10.0–800 µmol $L^{-1}$, with detection limits of 0.009, 1.0, and 4.0 µmol $L^{-1}$, respectively. The modified electrode was used for the determination of ISPT, AC and Trp in biological and pharmaceutical samples.

**Keywords:** Isoproterenol; Acetaminophen; Tryptophan; Modified electrode; Multiwall carbon nanotubes

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# The investigation of electron transfer of glucose Oxidase at graphene and graphene-cysteine modified electrode

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## Abstract

The direct electrochemistry of glucose oxidase (GOx) immobilized on graphene-cysteine was investigated.Thedirect electron transfer of active site in glucose oxidase on graphene and graphene–cysteine was investigated by cyclic voltametry.Cyclic voltametry show, the conductivity of graphene-cysteine is high than graphene. This work also developed a novel approach for glucose detection.TheCys/Gr composite was prepared as follows: first 4µL of graphene dropped ontoa glassy carbon electrode (GCE) and allowed to dry. Second, L-Cysteine (5mM) was poured in electrochemical cell then graphene modified glassy carbon electrode were immersed in it. The potential was scanned in 100mV/sand range -0.7 to +1.8mV. So, L-Cysteine diposited on electrode surface. Finally, glucose oxidase enzyme was immobilize on this Nano composite surface and activity was determined. Therefore, this study has not only successfully achieved DET reaction of GOxassembled on cysteine-graphene,but also established a novel approach for glucose detection .

## Keywords

**Graphene-Cysteine; Glucose Oxidase; Electrochemistry**

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Functionalized SBA-15 /Au nano particles modified SPE for investigation of Gquadruplex-drug interaction

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## Abstract

In the recent years, the G-quadruplexes (GDNA) have become the focus of attention because they are found in telomeric regions of chromosomes and oncogene promoter sequences. The electrochemical biosensor was prepared by modifying screen-printed graphite electrode (SPE) with synthesized functionalized SBA-*15* mesoporous structure and then Au nano-particles were electrodeposited in the nano size channel of SBA-15, then the GDNA/drug interaction was investigated in this platform. The pore of functionalized SBA structure can act as a nano-reactor and after modification with Au nano particles, self-assembly of GDNA could take place in these reactors. The structure of modified electrode was characterized by scanning electron microscopy (SEM). The interaction of drug with GDNA was studied in Tris-HCl buffer and also in the presence of $[Fe(CN)_6]^{3-}$ as a redox label using the CV method. The G-quadruplex formation and interaction mechanism between GDNA/drug was also identified by circular dichroism (CD) measurements.

**Keywords:** Gquadruplex DNA; Mesoporous structure; Au nano particle;

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**4 , 5 December 2013**

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# Compare of bamboo-like carbon nanotube and multiwall CNTs/ Ionic-liquid as a highly sensitive nano-composite for choline biosensing

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**Introduction**:recently , the direct electron transfer(DET) between the redox proteins and the electrode surface has received more and more attentions. The DET between proteins and electrods provide an ideal model for mechanistic studies of electron transfer in real biological systems, and play an important role for fabricating protein based biosensors, biomedical devices, and enzymatic bioreactors. A nano-composite consisting of bamboo-like and multi walled carbon nanotubes and a room temperature ionic liquid (1-butyl-3-methylimidazolium tetrafluoroborate) was prepared and used for modification of glassy carbon electrode.

**Method**: . By immobilizing choline oxidase on the modified electrode, the enzyme direct electron transfer has been achieved. The modified electrode exhibited a pair of well-defined cyclic voltammetric peaks at a formal potential of -0.423 V versus Ag/AgCl in 0.2 M phosphate buffer solution at pH 7.0. This peak was characteristic of ChOx-FAD/$FADH_2$ redox couple.

**Results**:The electrochemical parameters such as charge transfer coefficient (α) and apparent heterogeneous electron transfer rate constant (ks) was estimated to be 23.11$s^{-1}$and 1.75 $s^{-1}$, for Bamboo and Multi wall CNTs respectively. The enzyme electrode showed a very high sensitivity 294 , 51.67 µA mM-1 cm2 for Bamboo and Multi wall toward choline. Under the optimized experimental conditions, choline was detected in the concentration range from 1.2×10-2 - 2.8 10-1 × mM for Bamboo and 1.3×10-1 - 3 ×10-1 for Multiwall CNTs with a detection limit of 0.28 µM and 3.08 µM for Bamboo and Multi wall CNTs were messured.

**Conclusion:**we investigated the conformational change of ChOX absorbed onto carbon nano tube surfaces using both Raman and FTIR, to elucidate the underlying mechanism for DET between ChOX and CNTs-modified electrods We realized that Bamboo carbon nanotube has a high potential for third-generation biosensor design

**Key words:** ioniq liquid , Bamboo carbon nanotube,Multi Wall CNTs , Biosensors.

**Acknowledgement:** Thanks from research Center of Nanobiotechnology, Baqiyatallah University of Medical Sciences

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Application of Modified Magnetic Nanoparticles for Selective Extraction and Determination of Europium in Agricultural Water Samples

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## Abstract

Application of magnetic nanoparticles has been improved according to their special properties [1-3]. The presented study investigates the application of new modified $Fe_3O_4$ nanoparticles ($Fe_3O_4$@$SiO_2$) as a selective sorbent for selective sensing of europium (Eu) in environmental water samples. The procedure could be performed by using small amount of sorbent with high capacity during to the special properties of magnetic nanoparticles. Elution step was performed by using 1.5 mL nitric acid ($1molL^{-1}$) and the desorbed analyte was measured. Effect of different parameters such as pH, sorption and desorption time, type and concentration of eluent, interfering ions were investigated and optimized. Under the optimized conditions the detection limit for Eu was 0.04 $\mu gL^{-1}$, the relative standard deviation was 3.2% for 5 times analysis and the sorbent capacity was calculated as 26.5 $mgg^{-1}$. The linearity of the method was obtained within the range of 0.5-1000 $\mu gL^{-1}$ and the efficiency was 93.3%. Accuracy of the method was evaluated by real sample analysis. The calculated relative recoveries (95–106.5%) show the reliability of the method for determination of europium in real samples.

**Keywords:** Europium; modified magnetic nanoparticles; environmental water samples

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Carbon ceramic electrode modified by platinum nanoparticles dispersed into polyaniline film for methanol electrooxidation

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## Abstract

Fuel cells, the energy converting devices with a high efficiency and low or zero emission are attracting increasing attention in recent decades due to high energy demands, fossi fuel depletion and inviormental pollution [1]. Carbon ceramic electrode, a new electrode substrate, was prepared by sol-gel procedure [2] and used for the electropolymerization of aniline and dispersion of platinum nanoparticles into the resulting polyaniline film. Aniline monomers were polymerized on carbon ceramic electrode by cyclic voltammetry. Then its surface was potentiostatically coated with Pt nanoparticles at -0.2 V (vs. SCE).The electrocatalytic oxidation of methanol at this modified electrode (CCE|PANI|Pt) has been investigated by cyclic voltammetry.

**Keywords:** Carbon ceramic electrode, Methanol, Nanoparticles, Polyaniline

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Preparation and Comparison of Nonprecious Metal Catalyst Activity for Oxygen Reduction Reaction

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## Abstract

Proton exchange membrane (PEM) fuel cells have required the use of active catalysts to promote oxygen reduction reaction at the cathode .Recently many researchers offered non-precious metal alternatives such as transitional metals instead of platinum to reduce the final cost and improve the performance of the catalyst. In this work different loading of Iron and Cobalt nanoparticles on multi-walled carbon nanotubes have been prepared by polyol method. Then their electrocatalytic activity toward oxygen reduction reaction was investigated. Multi-walled carbon nanotubes were first functionalized with nitric acid and then used as supporting material for Iron and Cobalt nanoparticles. Scanning electron microscopy were performed to investigate the morphology of functionalized MWNTs. SEM images clearly indicated that MWNTs were successfully functionalized. Cyclic voltammetry tests also were performed to study the activity of synthesized catalysts. CV results showed that changes in loading and kind of transitional metal nanoparticles lead to different catalytic activity.

**Keywords:** Non-precious metal, PEM fuel cell, Catalysts

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# Synthesis of Aluminium doped manganese dioxide by means of an electrochemical/chemical method

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## Abstract

Since the introduction of Laclanche batteries in the late 1900's, manganese dioxide has attracted intense attention because of its unique properties such as high availability and low toxicity and cost. Manganese dioxide is still a serious rival for other electrode materials, even after the replacement of Laclanche batteries by newer ones[1]. Manganese dioxide has an enormous theoric storage ability of 1450F/g but the actual storage ability is a complex function of structural parameters. A great number of research works have been conducted to investigate the effect of structural parameters such as crystalinity, particle size, crystalline lattice defect and degree of stochiometric deviation on electrochemical behavior and storage ability of manganese dioxide[2]. A promising way to improve energy exchange capabilities of manganese dioxide is doping with suitable substances. Different synthetic methods have been used to dope manganese dioxide with Al, Ni, Bi, Pb, Cr and Mo. The mechanism by which the dopant enhances the storage ability differs from case to case. While Ni is effective in stabilization of more electrochemically active but thermodynamically instable γ-$MnO_2$, Al facilitates the movement of charges species in $MnO_2$ lattice. Al is a good candidate when all parameters, including cost effectiveness and environmental impact, are considered. In this work a versatile method for the Al doping of $MnO_2$ via cathodic base generation from a mixed Mn/Al solution and heat treatment of the resulting mixed oxide is described. The effect of experimental parameters such as Mn/Al ratio, current density and heating parameters on morphology, composition, crystalinity and energy storage ability of doped samples are investigated by means of Scanning Eelectron Microscopy, Infra Red Spectrometry, X-Ray Diffraction and Cyclic Voltammetry.

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# Synthesis of Aluminium doped Manganese Dioxide by means of an Electrochemical/Chemical method

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## Abstract

Since the introduction of Laclanche batteries in the late 1900's, manganese dioxide has attracted intense attention because of its unique properties such as high availability and low toxicity and cost. A promising way to improve energy exchange capabilities of manganese dioxide is doping with suitable substances such as Al, Ni, Bi, Pb, Cr and Mo. Al is a good candidate when all parameters, including cost effectiveness and environmental impact, are considered. In this work a versatile method for the Al doping of $MnO_2$ via cathodic base generation from a mixed Mn/Al solution and heat treatment of the resulting mixed oxide is described. The effect of experimental parameters such as Mn/Al ratio, current density and heating parameters on morphology, composition, crystalinity and energy storage ability of doped samples are investigated by means of Scanning Eelectron Microscopy, Infra Red Spectrometry, X-Ray Diffraction and Cyclic Voltammetry.

**Keywords:** cathodic base generation, Al doped manganese dioxide, Energy storage.

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# Effect of Nafion content on cathode catalyst layer void volume and PEMFC performance

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## Abstract

In proton exchange membrane fuel cells, catalyst layers are key components for achieving higher performance and lower cost. Controlling the structure of the catalyst layers is important, since it can contribute to improving the transport of reactants and products in the catalyst layers. The content of Nafion ionomer in the electrode affects simultaneously the gas permeability, the catalytic activity and the ionic resistance. Hence, an optimum Nafion content in the catalyst layer is necessary for good performance. In this work dependence of Nafion content was examined in void volume of cathode catalyst layer (CCL). Various CCLs with different percentage of Nafion content (25, 28 and 31 wt %) were prepared then in order to examine effect of void volume on performance of these CCLs, some membrane electrode assemblies (MEAs) were prepared and were depicted polarization curves (I-V). According to depicted curves, 28 wt % of Nafion was assigned as optimum amount of Nafion content for CCLs.

**Keywords:** PEMFC, void volume, Nafion content, cathode catalyst layer

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# Zinc-Bismuth Alloy powder produced by the electrolytic deposition

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## Abstract

In this study, zinc -Bismuth Alloy powder Produced by electrolytic deposition method have been studied . Powder Zinc-Bismuth alloy Used in battery industry to Reduce anode corrosion. Therefore, Five Electrolysis bath were prepared, Consists of a zinc anode and a 316 Stainless Steel cathode, and alkaline electrolyte Consists of zincat and bismuth oxide solution was prepared by the same percentage . than, five different voltage for deposition of zinc- bismuth alloy was used . Percent of bismuth metal in Powders produced in any given voltage Were analyzed by Atomic Absorption. Atomic Absorption analysis showed that the powder has a maximum value of Bi element in 4.7 voltage. Capacity test, anodes made with zinc alloy powder with highest percentage of bismuth showed a higher operating time Compared with anodes made with pure zinc powder.

**Keywords: electrolytic deposition ;Zinc Alloy powder ;Zinc-Bismuth**

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# Electrocatalytic Oxidation of Methanol by Ni-Clinoptilolite Zeolite Nanoparticles Modified Carbon Paste Electrode

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## Abstract

Direct methanol fuel cells (DMFC) are efficient and environmentally acceptable conversion devices. However, some problems like relatively slow kinetics and continuous poisoning of the catalysts limit the performance of DMFC. Therefore development of materials with capability for the electrocatalytic oxidation of methanol is a great of interest. In this paper, after characterization of Clinoptilolite zeolite nanoparticles (NClin) by X-ray diffraction, tunneling electron microscopy and Brunauer–Emmett–Teller techniques, the cyclic voltammetry was used to investigate the electrochemical properties of a carbon paste electrode modified by Ni(II) ion exchanged NClin (Ni(II)-NClin/CPE). Also the electrocatalytic activity of the modified electrode for oxidation of methanol was described. The effect of some parameters such as zeolite particle size, kind and concentration of the electrolyte, pH of solution, electrode ingredients and potential scan rate was studied on the electrocatalytic behavior of the electrode for electrocatalysis of methanol. The oxidation of methanol at modified electrode occurs at a potential about 520 mV less positive than unmodified carbon paste electrode with high suitable anodic current. Also the catalytic rate constant for methanol oxidation by the proposed electrocatalyst obtained as 331 $M^{-1}s^{-1}$ by chronoamperometry.

**Keywords:** Methanol, Fuel cell, Clinoptilolite zeolite nanoparticles, Electrocatalysis

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# Determination of thermodynamic parameters of hydrogen permeation through palladium layer in Pd/oxPSS composite membrane

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**Abstract:**

A palladium composite membrane was prepared by electroless plating on nanoscale coarsened oxidized porous stainless steel support (ox-PSS). Hydrogen permeation flux through this composite membrane was measured in the temperature range of 574-674K and the pressure difference of two sides of membrane up to 90kPa. A simplified resistance model was employed to analyze the permeation behavior of hydrogen through Pd/ox-PSS membrane for calculating the contribution of each layer in resistance against the hydrogen transport. The amount of enthalpy of hydrogen dissolution of palladium membrane is -9.4kJ/mol. Considering a complete detailed model, this value was used for discussing the effect of interaction of metal- support on hydrogen exiting from the palladium layer at the downstream side.

**Keywords:**

Palladium composite membrane, Enthalpy of hydrogen dissolution, Porous stainless steel support

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A Reviwe of Refining of Secondary Lead for Use in Lead-Acid Batteries

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## Abstract

Secondary lead, i.e. material produced by the recycling of lead-acid batteries has become the primary source of lead in much of the world. This has been important to the secondary lead industry as other uses have dwindled, e.g. lead based pigments, chemicals, fuel additives, solders and CRT glasses. Presently, battery manufacturing accounts for greater than 80% of lead consumption while recycled lead accounts for approximately the same market share of lead supply. These two facts strongly demonstrate the battery manufacturing and recycled lead are intimately coupled in everyday life. In this paper we will explore how recycled lead has become the material of choice for battery construction through the development of a recovery and refining process that exceeds the industries requirements. Particular focus will be on the effects of contaminant or tramp elements on gassing in lead-acid batteries**.**

**Keywords:** Lead-Acid Batteries, Secondary Lead, Refining, Hydrometallurgy.

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# Advance batteries

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## Abstract

In this paper theory and applications of advance batteries such as Lithium (primary and secondary), aluminum (zinc) /silver oxide, nickel/cadmium and metal/air batteries

Were studied.

**Keywords:** Advance Batteries; Lithium Batteries; Aluminum (zinc) /silver oxide Batteries; Nickel/Cadmium Batteries; Metal/air Batteries.

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1. Ph. D. in Analytical Chemistry

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Effect of nano electrolytic $MnO_2$ on charge/discharge cyclic of zinc/alkaline batteries

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## Abstract

In this paper nano electrolytic $MnO_2$ (nano EMD) was prepared by pulse electrochemical method and crystal structure and particles size of nano EMD were examined by XRD and Transmission Electron Microscopy(TEM), respectively. The electrochemical performance of zinc/alkaline cells composed of nano EMD (20nm) and micro EMD (80 µm) were examined by using potentioactate (AUTOLAB-30). The results shown that cell contain nano EMD have excellent charge/discharge cyclic (more than 200 cycles) than micro $MnO_2$ (40 cycles).

**Keywords:** zink/alkaline cell; nano electrolytic manganese Dioxide (nano EMD); electrochemical properties; charge/discharge cyclic.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Desalination of Brackish Water by Capacitive Deionization

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## Abstract

Capacitive deionization (CDI) is a process of brackish water desalination in which salts and are removed from water by applying an electric field between two porous electrodes, similar to electric double-layer capacitors. In this work, for enhancement of the desalination performance of carbon-based electrodes, an $MnO_2$/carbon composite electrode was manufactured by mixing activated carbon powders, PTFE binder and $MnO_2$ powder. Electrochemical analysis of prepared electrode demonstrated that its salt removal efficiency was 388 µmol/g which was higher than (178 µmol/g) that of the commercially available activated carbon (AC). Moreover The capacitance of the $MnO_2$/carbon composites (28 F/g) was higher than the AC (16 F/g). High salt removal efficiency and capacitance of the $MnO_2$/carbon composite demonstrated its good performance for the CDI process in brackish water desalination applications.

## Keywords

Capacitive Deionization; Desalination; Activated Carbon Powder; Capacitance

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# Electrochemical Performance of Polyaniline-based Carbon as Electrode Material for Supercapacitor

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## Abstract

A supercapacitor is a charge storage device between the electrostatic capacitor and the rechargeable battery. It has been used as an energy storage system for portable electronic devices, backup power sources, and hybrid electric vehicles [1-6]. Carbon materials, conducting polymers and transition metal oxides, such as hydrous $RuO_2$ and $MnO_2$ have been identified as possible electrode materials [7-10]. In the present study the manganese oxide and polyaniline (PANI) was chemically deposited on carbon black (Cb) electrode. The capacitance and stability of this composite film were investigated by cyclic voltammetry (CV). The redox properties of the PANI-$MnO_2$/Cb exhibited ideal capacitive behavior in a 0.5 M $Na_2SO_4$ solution. The capacitance of PANI-$MnO_2$/Cb can reach 179.8 F $g^{-1}$ and maintains about 91% of the initial capacitance after 100 cycles. This indicates that the improved electrochemical performance of PANI-$MnO_2$/ Cb is due to the enhanced electrical properties by $MnO_2$ and PANI coating onto Cb.

Keywords: **Supercapacitor; Polyaniline; Carbon**

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# Capacitive behavior of ultrathin polyaniline for high speed super capacitors

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## Abstract

Herein we report electrochemical synthesis of polyaniline (PANI) film by cyclovoltammetery (CV) method in low monomer concentration and study capacitive performance of PANI electrode. Different thickness of polymer film synthesized by increase of cycles. Morphology study of electrode shows that polymerization in low monomer concentrations was directional form. Capacitance of electrode was studied by CV, charge-discharge (CD), and impedance spectroscopy (EIS) methods.

**Keywords: Ultra-thin, poly aniline, morphology, impedance spectroscopy.**

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**4 , 5 December 2013**

**University of Tarbiat Modares, Tehran, Iran**

# Electrodeposited $Ni(OH)_2$ nanostructures on electroc-etched carbon fiber for exceptionally stable supercapacitors

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## Abstract

In the present study, electroc-etched carbon fiber paper (ECFP) is introduced as an excellent supporting substrate for electrodeposition of nickel hydroxide nanostructures. After typical carbon fiber was electroc-etched, it exhibited increased real surface area and hydrophilicity, leading to higher loading mass of Ni(OH)2 with fine porous morphology as confirmed by SEM images. Also, an intimate contact between Ni(OH)2 nanostructures and ECFP contributed to high rate capability and excellent cycling stability (100% capacitance retention) of ECFP/Ni(OH)2 electrodes, as result of increased surface hydrophilicy. Nanostructured $Ni(OH)_2$ deposited on ECFP were characterized by scanning electron microscopy (SEM) and X-ray diffraction(XRD). The electrochemical performance of ECFP/Ni(OH)2 was studied in symmetric two-electrode system by electrochemical techniques such as cyclic voltammetry (CV), galvanostatic charge-discharge, and electrochemical impedance spectroscopy (EIS). A maximum specific capacitance of 555.4 F.g-1 was achieved for ECFP/$Ni(OH)_2$ single electrode.

**Keywords: $Ni(OH)_2$ nanostructures, pseudocapacitor, high cycling stability**

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# Electrodeposited $Co_3O_4$ Nanostructures on Carbon Fiber Substrate for Application in High-rate Supercapacitors

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## Abstract

Herein, the electrochemical fabrication of cobalt oxide nanostructures on porous carbon fiber (PCF) by a cathodic potential step method is described. The morphology and composition of the nanostructures were studied by scanning electron microscopy (SEM), X-ray diffraction analysis (XRD) and thermal analysis (TA) methods. SEM images confirm the formation of $Co_3O_4$ nanostructures on PCF ($Co_3O_4$-PCF). Electrochemical behaviors of $Co_3O_4$-PCF were studied by cyclic voltammetry (CV), galvanostatic charge-discharge, and ac-impedance method. Our results verify the outstanding supercapacitive behavior of $Co_3O_4$-PCF with good cycling stability. These characteristics originate from three dimensional structures of nanostructures which allow facile electrolyte transportation. A specific capacitance of 598.9 F $g^{-1}$ at a currents density of 3.1 A $g^{-1}$ was obtained for $Co_3O_4$-PCF electrode.

**Keywords:** Supercapacitor, Carbon fiber, Cobalt oxide, Nanostructures.

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4 , 5 December 2013

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# study the capacitive behavior of electro-co deposited poly aniline/ Nano structural MnO2 composite using FFT continuous cyclic voltammetry.

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## Abstract

Capacitive behavior of electro chemically synthesized poly aniline/ Nano structural $MnO_2$ was studied by electrochemical methods such as cyclic voltammetry, impedance spectroscopy, charge-discharge and fast Fourier transform method. Capacitance of poly aniline electrode calculated about 324 F/g and this capacitance for composite electrode was about 600 F/g. the stability of electrode also increased and measured by FFT continuous cyclic voltammetry. Results from methods were in agreement together. This composite electrode showed good capability for using in super capacitor devises.

**Keywords: FFT continuous cyclic voltammetry, Nano structural $MnO_2$, poly Aniline composite.**

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4 , 5 December 2013

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# The application of Silver Compounds/$TiO_2$ Nanoparticles in Watersplitting for Hydrogen production

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**Abstract**

Growing demand on energy and limitation and consequence of fossil fuels has caused to utilize the clean and renewable energy sources. Hydrogen is a clean energy carrier which produced just water vapor during combustion. One of the newest methods to produce Hydrogen without application of fossil fuels is using semiconductors such as $TiO_2$ to spilt water and produce $H_2$ by solar irradiation. Reducing the energy gap of these semiconductors to match the solar spectrum, especially in its visible range, modification of their structures, surfaces and stability are the main challenges in hydrogen production processes [1-2]. Recent intensive studies have indicated that the silver halides and silver on silver halides/$TiO_2$ structures possess excellent photocatalytic activity and high stability under solar irradiation [3]. In this research, $TiO_2$ thin films containing different concentrations of silver halides particles have been synthesize and used as photoanode in the photoelectrochemical cell to produce hydrogen from water. Physical and photoelectrochemical characterization of silver halide/$TiO_2$ thin films investigates with SEM, TEM, and CV methods.

**Keywords**: Watersplit, $TiO_2$, Silver compounds, Photoanode.

**References**:

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# The application of Silver Compounds/$TiO_2$ Nanoparticles in Watersplitting for Hydrogen production

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**Abstract**

Growing demand on energy and limitation and consequence of fossil fuels has caused to utilize the clean and renewable energy sources. Hydrogen is a clean energy carrier which produced just water vapor during combustion. One of the newest methods to produce Hydrogen without application of fossil fuels is using semiconductors such as $TiO_2$ to spilt water and produce $H_2$ by solar irradiation. Reducing the energy gap of these semiconductors to match the solar spectrum, especially in its visible range, modification of their structures, surfaces and stability are the main challenges in hydrogen production processes [1-2]. Recent intensive studies have indicated that the silver halides and silver on silver halides/$TiO_2$ structures possess excellent photocatalytic activity and high stability under solar irradiation [3]. In this research, $TiO_2$ thin films containing different concentrations of silver halides particles have been synthesize and used as photoanode in the photoelectrochemical cell to produce hydrogen from water. Physical and photoelectrochemical characterization of silver halide/$TiO_2$ thin films investigates with SEM, TEM, and CV methods.

**Keywords:** Watersplit, $TiO_2$, Silver compounds, Photoanode.

**References**:

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Synthesis of Nano composite $TiO_2$ nanotube/$SnO_2$-Pt/C as Anode Materials for Li Ion Batteries

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## Abstract

Lithium rechargeable batteries are now well established as power sources for portable equipment. Wide range of high theoretical capacity Tin oxide composite is under study as the anode materials of these batteries. TNT/SnO2-Pt/C composite as anode materials was synthesized by Tin oxide nanoparticles that embedding on high cycleable nanotube titanium oxide substrate and improving its electrical conductivity by Vulcan XC-72 and Pt metal. Electrode performance was tested by charge/discharge galvanostatic and cyclic voltammetry experiments. Percent components of Tin oxide, Vulcan, and Pt metal are exactly calculated. The structure of nanotube titanium oxide will be studied by scanning electron microscope (SEM).

**Keywords:** Li ion battery, Anode, tin oxide, nanotube titanium oxide, Electro deposition

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4 , 5 December 2013

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# Poly electrolyte assisted syntheses of graphene supported Pt nanoparticles as electrocatalyst for Oxygen reduction reaction

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## Abstract

In this work graphene nanosheets (GNSs), which acts like both single-layer graphene and highly graphitic carbon reported as a support material for Pt nanoparticles for oxygen reduction in fuel cells. Pt nanoparticles are deposited on Graphenes protected by Polyvinylpyrrolidone (PVP) and acrylamide/β methacryl-oxyethyl-trimethyl-ammonium (Superfloc C-442)
**Keywords:** Graphene, PEM fuel cell, oxygen reduction, Pt nanoparticles

Polymer electrolyte fuel cells (PEFCs) are promising primary power source for future. Both the anodes and cathodes of PEFCs, however, platinum or its alloys are required as the catalyst, having a high activity at low operating temperatures <100°C. For the commercialization of PEFCs, it is very important to reduce the amount of platinum catalyst used while maintaining the durability. Recently in several works use of graphene nanosheets as a support for Pt catalyst has been reported. Seger et al reported the of Pt nanoparticles on reduced graphene oxide sheets and their utilization in proton exchange membrane assembly.

GO was synthesized from fine extra pure graphite powder (Merck) by the method of modified Hummers and Offeman 100 mg of exfoliated Go was added to round bottom and NaBH4 (100cc, 50 mmol) drop wisely added to exfoliated Go. The round bottom refluxed and heated in an oil bath at 120 ºC under argon atmosphere for 24 h over which the reduced GO gradually precipitated out as a black solid. The product has been washed with water and methanol (100 mL) copiously, and dried in vacuum oven for 48 h in 100 ºC. Graphene nanosheets (GNS), which exhibit the advantages of single-layer graphene and highly graphitic carbon, were employed as an alternative support material for Pt nanoparticles for oxygen reduction than commercial ElectroChem Pt/C and other graphene.

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# PAN Fiber Composite of Carbon Materials as Carbon Fiber Paper in PEM Fuel Cells

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## Abstract

Substrate or Current collector of PEM fuel cell active layer in gas diffusion electrode must be conductive, porous, semi hydrophobic and non corrosive in PEM fuel cell condition. In this work a porous cathode material substrate with high porosity and acceptable double layer capacitance prepared. For this propose we made a series of PAN mixture with graphite and carbon Vulcan in different percent and as result of our research, the best substrate cathode was made in 30/70 ratio of carbon Vulcan vs. PAN. We used Scanning Electronic Microscopy to evaluation of carbonize active material structure after thermal processing and EIS, CV and CP for electrochemical operation evaluation.

**Keywords:** Poly Acrylo-Nitrile; PEM Fuel cell; Carbon fiber paper; carbonized material

## 1 Experimental

### 1.1 PAN Fiber Composite of carbon materials

Fiber composite of PAN with different mass ration of graphite or carbon Vulcan was prepared by mixing of them to make 10, 20 and 30 (w/w) percent of carbon material vs. PAN and then solute the mixture in DMF and stir with ultrasonic for 5 to 10 minute. With apply $N_2$ gas, spew solution from a perforated mesh and enter in coagulation bath to shape fiber composite and then stabilization, oxidation, precarbonization and carbonization steps were done.

### 1.2 Carbon fiber paper

The prepared fiber composite in last step grind and mixed with 12% Teflon solution and exerted in expanded copper mesh and then press with hot press in 80 Kg/cm$^2$ pressure at 200 – 300 °C.

## 2 Results

SEM results show increase of carbon Vulcan percent in fiber composite caused the increase of porosity and mechanical bonding versus graphite additive or pure PAN, and the Chronopotentiometry results show the increasing in capacitance of formed double layer in solution. Also The EIS results show that electronic conductivity increase by increasing the vulcanized carbon in composite.

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Nanostructured bimetallic Pt-Pd alloy on functionalized carbon supports as PEMFC electrocatalysts for oxygen reduction reaction

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**Abstract**

Electrocatalytic activity of carbon supported Pt-Pd alloy electrocatalysts of different Pt $Pd_x$ atomic ratios (x = 0.25, 0.5, 1 and 2) formed by the impregnation synthesis method, was investigated with regard to the oxygen reduction reaction (ORR) in sulforic acid solution. To improve the utilization and activity of cathodic catalysts for ORR reaction, the alloy nanoparticles were loaded on the mixture of Vulcan XC-72 and MWCNT (1:3), which were functionalized in the mixture of 96% sulfuric acid and 4-aminobenzenesulfonic acid using sodium nitrite to produce intermediate diazonium salts from substituted anilines. The performance of the electrodes for the ORR was measured using electrochemical techniques, inductive coupled plasma (ICP), X-ray diffraction (XRD) and transmission electron microscope (TEM). For the synthesized Pt $Pd_x$/C electrocatalysts, the highest catalytic activity for the ORR, was found for a Pt:Pd atomic ratio of 2:1 in acidic media. Since the sulfonation of carbon-supported catalysts as mixed electronic and protonic conductors is an efficient way to increase the triple-phase boundaries, the modified electrocatalysts showed better performance compared to unsulfonated one.

**Keywords:** Nanostructured Pt-Pd alloy; functionalized carbon support; oxygen reduction reaction

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Preparation of Nitrogen Doped Graphene as a new Platinum Support in PEMFCs

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## Abstract

In this work, C-graphene composed of core graphene and carbon shells was prepared to obtain a new type of carbon support materials. Carbon shells containing nitrogen groups were prepared by coating polyaniline (PANI) onto graphene by in situ polymerization with ammonium per sulfate and subsequent carbonization at 250 ◦C in oxygen atmosphere and then at 850 ◦C in nitrogen atmosphere. After carbonization, the C-graphene contained nitrogen atoms showed electro chemical activity for ethanol oxidation in acidic media; Raman ,IR and XRD spectroscopy indicated that the graphene was synthesized and doped with nitrogen. After preparation of support, Pt nanoparticles deposited on the new support. The performance of the electro catalysts for the ORR was measured by electrochemical techniques and the results show that the new support had better performance for fuel cell reactions.

**Keywords:** graphene, pt nanoparticle, fuel cell, nitrogen doped

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Pt-$SnO_2$/C Electrocatalyst for Ethanol Oxidation in Acid environment

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## Abstract

An interesting alternative to H2-fueled PEMFC for portable and mobile application is the use of ethanol as a fuel (DEFC) [1]. Many studies have pointed Pt-Sn/C as the best electrocatalyst for ethanol electro-oxidation (EOR) in acid environment. However, these kinds of alloys usually show relatively low selectivity for $CO_2$ formation compared with Pt alone [2]. Zhu et al. [3] synthesized Pt-$SnO_2$ and PtSn alloy catalyst. The analysis of the products shows that addition of $SnO_2$ enhanced the total oxidation to $CO_2$.

In this work, we synthesized $SnO_2$ by an ex situ method and made a binary catalyst by adding a tin oxide to Pt and its performance compared with Pt-Sn. Pt-$SnO_2$ and Pt-Sn catalysts supported on carbon were synthesized by a modified polyol method. The XRD analysis showed the alloy catalyst was synthesized. Electrochemical tests such as CV,LSV, Chornoamperometry and EIS were performed for two catalysts. The CV results indicate that the onset potential of two catalysts was same but the ratio of $I_f/I_b$ ($CO_2$ tolerance) for Pt-SnO2 was greater than Pt-Sn. The EIS technique was used to investigate the catalytic activity for the CO oxidation and Pt-SnO2 have a beter tolerance to $CO_2$.

**Keywords:** Tin Oxide, Ethanol Oxidation, DAFC.

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**9th Iranian Annual Seminar of Electrochemistry**

**4 , 5 December 2013**

**University of Tarbiat Modares, Tehran, Iran**

# Novel composition for anode and cathode in biofuel cell

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Abstract

The biofuelcells are energy harvesting devices that used in medical treatments. In this paper we prepared a novel composition for enzyme immobilization that used in biosensor and especially biofuel cell . Power of biofuel cell is near 10microwatt per square centimeter. The stability of the composition is 7 months.

Keywords: Biofuel cell, carbon nano tube , Poly dially ammonium chloride(PDDA)

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4, 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Comparision the Performance of the Optimized PtSn and Commercial PtRu in a Passive DMFC

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## Abstract

Polyaniline fiber (PANI) was synthesized by chemical interfacial method and utilized to fabricate Vulcan-Polyaniline (C-PANI) composite. PtSn(70:30) nanoparticles are reduced on C-PANI composite by Ethylenglycol and the performance of the PtSn(70:30)/C-PANI and commercial PtRu/C, as anode catalysts, are compared in a passive direct methanol fuel cell. The DMFC test results indicate that the membrane electrode assembly (MEA) prepared from PtSn(70:30)/C-PANI anode exhibits better performance in terms of maximum power density and stability. Also the methanol crossover in the presence of PtSn(70:30)/C-PANI has been reduced by 42%. In comparison with the commercial PtRu/C catalyst, the optimal PtSn(70:30)/C-PANI catalyst exhibits superior activity toward methanol oxidation.

**Keywords:** Polyaniline, Passive direct methanol fuel cell

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Performance Analysis of a PEM Fuel Cell at Different Cathode Relative Humidity

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## Abstract

The performance of a fuel cell is characterized by its polarization curve. In this study, the performance of a PEM fuel cell is measured experimentally for different cathode relative humidity. The experimental data are used in estimating the parameters of a completely analytical model that describes the I-V curve. The analytical model consists of the three fundamental losses experienced by a fuel cell, namely: activation, ohmic, and concentration losses. While the Tafel constants, exchange current density and the concentration loss constant are estimated through regression, ohmic resistance is obtained through measurements. The effect of cathode relative humidity on the fuel cell performance and the exchange current density is also investigated. The estimated parameters derived in the literature are found to reasonably fit the obtained experimental data.

Keywords: **PEM fuel cell; Oxygen reduction reaction, Cathode exchange current; Cell resistance**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Impedance Response Analysis of PEM Fuel Cell under Different Operation Conditions

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## Abstract

This paper mainly presents the AC impedance characteristics of a PEM fuel cell under different operating conditions. Cathode relative humidity and operating pressure are shown to have significant effects on the AC impedance of cell. Based on the impedance spectra, charge transfer resistance, mass transfer resistance, and solution resistance can be extracted using the equivalent circuits set up. The Nyquist plots were fitted by Zview software. When cathode relative humidity decreases, higher ohmic and charge transfer resistances can be observed. Also the capacitance parameters increase with enhancing relative humidity. With increasing of the gases pressure, solution resistance was increased, this may be related to the enhancement of the contact resistance between diffusion medium and flow field plates in the anode and cathode sides. While increasing the operating pressure leads to a water flooding in electrode, resulting higher mass transfer resistance.

Keywords: **PEM fuel cell, Electrochemical impedance spectroscopy, Cathode relative humidity, operating pressure**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Corrosion behavior of Hot-Dip galvanized steel sheets in Zn-5%Al,coated in different conditions

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## Abstract

In this study we examined and compared the corrosion behavior of hot galvanized steel sheets coated in a bath of molten Zn-5%Al with different conditions of coatings using the dynamic polarization test. Therefore, the molten bath immersion's temperature and the immersion times were changed; and the effect of temperature and time of immersion bath on the corrosion behavior of coatings with different conditions was examined. The results showed that with higher temperatures of molten bath immersion results in increased corrosion rates and decreased corrosion resistance of the samples because of the formation of intermetallic phases. Also for a constant temperature of the molten bath; the corrosion rates increased with longer immersion times, that is, the longer times of the bath immersion the higher corrosion rates.

**Keywords: Corrosion ;Hot-Dip galvanizing;Zn-5%Al**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Inhibition of the Corrosion of Carbon Steel in HCl Solution by *Pistacia Terebinthus* Extract

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## Abstract

Corrosion of steel is an electrochemical process that causes the dissolution of iron. In this work the effect of addition of *Pistacia terebinthus* extract on carbon steel dissolution in 1.0 M hydrochloric acid was studied through potentiodynamic polarization curves, electrochemical impedance spectroscopy (EIS) and gravimetric measurements in the temperature range from 25 °C to 65°C. The corrosion rate of steel was decreased in the presence of extract. The inhibition efficiency was found to increase with extract concentration to attain 94.8% at 2.5 g/L. EIS measurements show an increase of the transfer resistance with increasing inhibitor concentration. Temperature studies revealed an increase in inhibition efficiency with rise in temperature and activation energies decreased in the presence of the extract. The adsorption of this plant extract on the carbon steel surface obeys the Langmuir adsorption isotherm.

## Keywords

Corrosion inhibition; *Pistacia terebinthus* extract; Carbon steel; HCl.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Adsorption and corrosion inhibition of *Allium hirtifolium* extract on carbon steel corrosion in $H_2SO_4$ acidic media

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## Abstract

In chemical industry, acid solutions are generally used for removal of undesirable scales and rusts on steel surface. These operations usually induce serious corrosion of steels. To retard this dissolution of metal, inhibitors are used in acid solutions. In this study, the inhibitive action of *Allium hirtifolium* extract on corrosion of carbon steel in 0.5 M $H_2SO_4$ solution was investigated through weight loss measurement as well as potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) techniques. Polarization measurements indicate that inhibitor acts as a mixed inhibitor and inhibition efficiency increases with inhibitor concentration. The inhibition action of the extract was discussed in view of Langmuir adsorption isotherm. The effect of temperature on the inhibition efficiency was studied. Quantum chemical parameters were also calculated, which provided reasonable theoretical explanation for the adsorption and inhibition behaviour of *Allium hirtifolium* extract on the carbon steel.

**Keywords**

Carbon steel; Corrosion inhibitor; *Allium hirtifolium extract*; $H_2SO_4$.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Corrosion inhibition of aluminium in alkaline media by Berberis vulgaris root extracted

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## Abstract

In this paper the inhibitive action of root extracts of Berberis vulgaris on aluminium corrosion in 1 M NaOH solutions was studied using potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) methods. EIS measurement was carried out in the 100 kHz–10 mHz frequency range at open circle potential (OCP). The linear Tafel segments of the anodic and cathodic curves were extrapolated to corrosion potential ($E_{corr}$) to obtain the corrosion current densities ($I_{corr}$). Nyquist plots present two capacitive semicircles at higher and lower frequencies separated by an inductive loop at intermediate frequencies. The results show that inhibition efficiency increased with an increase in extract concentration and increase physical adsorption. potentiodynamic polarization results reveal that the inhibitor act as a mixed type inhibitor. The results also show that root extracts of Berberis vulgaris is a good inhibitor in 1M NaOH Solution.

*Keywords:* ***Aluminium, Alkaline corrosion, EIS, Berberis vulgaris.***

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Preparation and study of the corrosion behavior of electrodeposited Ni-Fe and Ni-Fe-C nanostructures coatings in 1M NaOH

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## Abstract

Ternary nickel-iron-carbon (Ni-Fe-C) alloys have been characterized by means of microstructural and electrochemical techniques in view of their possible applications as electrocatalytic materials for hydrogen evolution reaction (HER).The corrosion protection performance of electrodeposited Ni-Fe and Ni-Fe-C composite coatings on copper substrates was studied. The effect of heat treatment on the coatings performance was also studied. The investigated coatings performance has been evaluated on the basis of electrochemical data obtained from the potentiodynamic polarization Tafel curves and electrochemical impedance spectroscopy in 1 M NaOH solution at 298 K. The results showed that incorporation of carbon nanoparticles from l-lysine source into Ni-Fe matrix increased significantly corrosion resistance of the coating resistant in alkaline solution than the as-deposited coatings.

**Keywords:** Fuel cell; Corrosion; Electrochemical Impedance Spectroscopy; Ni-Fe-c Nanostructure; Hydrogen Evolution Reaction; Electrochemical Deposition

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**9th Iranian Annual Seminar of Electrochemistry**
**4 , 5 December 2013**
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# Electrochemical investigation of adsorption and inhibitory of 1,4-$Ph(OX)_2(Ts)_2$ on corrosion of aluminium in acidic media

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## Abstract

Aluminium and aluminium alloys represent an important category of materials due to their high technological value and wide range of industrial applications, especially in aerospace and household industries. Owing to these applications of aluminium and its alloys, considerable attention has been devoted to the corrosion behaviour of these materials in various aggressive environments.
Organic compounds bearing heteroatoms with high electron density such as phosphor, sulphur, nitrogen, oxygen or those containing multiple bonds which are considered as adsorption centers, are effective as corrosion inhibitor. The compounds contain both nitrogen and sulphur in their molecular structure have exhibited greater inhibition compared with those contain only one of these atoms. In literature many thiazole derivatives have been studied as corrosion inhibitor and found that thiazole derivatives have good corrosion inhibition effect.
In this study organic oxazol derivative, 1,4-$Ph(OX)_2(Ts)_2$ was synthesized and its inhibiting action on the corrosion of aluminium in sulphuric acid was investigated by means of potentiodynamic polarization and electrochemical impedance spectroscopy (EIS). The results of the investigation show that this compound has excellent inhibiting properties for Al corrosion in sulphuric acid. Inhibition efficiency increases with increase in the concentration of the inhibitor. The adsorption of (1,4-$Ph(OX)_2(Ts)_2$ ) onto the Al surface followed the Langmuir adsorption model with the free energy of adsorption $\Delta G^0_{ads}$ of -12.9 kJ $mol^{-1}$. Quantum chemical calculations were employed to give further insight into the mechanism of inhibition action of 1,4-$Ph(OX)_2(Ts)_2$.

**Keywords:** inhibitor, Al, DFT, impedance

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Study of Pitting Corrosion on Copper Using Some Imidazoles; A Computational Study

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Very recently, researchers have found that some Imidazoles 4-methyl-1-(p-tolyl)-imidazole, 4-methyl-1-(o-tolyl)imidazole, and 4-methyl-1-phenyl imidazole efficiently inhibited copper corrosion in 3% NaCl, however, slow formation of a thick layer was observed for 4-methyl-1-phenyl imidazole. The solvent effect on corrosion inhibitor properties has been investigated by Density Functional Theory (DFT) at B3LYP methods and second-order Møller-Plesset Perturbation Theory (MP2) using 6-31++G* basis set. Quantum chemical parameters such as highest occupied molecular orbital energy ($E_{HOMO}$), lowest unoccupied molecular orbital energy ($E_{LUMO}$), energy gap ($\Delta E$), dipole moment ($\mu$) and fraction of electrons transferred from the inhibitor molecule to the metallic atom ($\Delta N$) have been calculated in neutral and protonated form. The relationship between $\Delta N$ values of these compounds and their inhibition efficiency is studied. The result of inhibitor/copper optimization revealed adsorption position due to the lone pair electron of nitrogen atoms. Our calculations is in good agreement with the recent experimental observation.

**Keywords:** Corrosion; Copper; Neutral Inhibition; Computational Study

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Electrochemical evaluation of the effect of temperature on the corrosion behaviour of Admiralty Brass alloy in thermal power plant condenser

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## Abstract

Thermal power plant condenser is one of the most important auxiliary equipments in a power plant. A condenser has a large number of cooling tubes with the cooling fluid. Water is the most commonly used cooling fluid to remove unwanted heat from tubes. Cooling water contains dissolved and suspended solids, organic matters and dissolved gases. So, two of the main problems of cooling water systems are corrosion and scale phenomena. Many corrosion and scale inhibitors have been used in cooling water systems in order to solve these problems.Temperature is one of the important parameters which influence the performance of inhibitors and corrosion rate. In this research, effect of cooling water's temperature on the corrosion behavior of thermal power plant condenser tubes which is made of Admiralty Brass (AB) (CDA 443, Cu: 70%, Zn: 29%, Sn: 1%), was investigated by electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization methods at 20,25,30 and 35℃. Electrochemical experiments were carried out with Autolab (PGSTAT-302) in a standard three- electrode cell. The pH of cooling water was adjusted at 7.8. Results showed that as the temperature increases from 20 ℃ to 35 ℃, $i_{corr}$ increased from 0.424 μAcm$^{-2}$ to 0.994 μAcm$^{-2}$ and $E_{corr}$ shifted to negative values. Corrosion rate increased from 0.41 MPY to 0.91 MPY. The impedance parameters obtained by using two time constant equivalent circuit model and indicated that with increasing temperature from 20 ℃ to 35 ℃, the resistive films of corrosion and/or scale products on the surface of AB were dissolved gradually. So, polarization resistance ($R_p$) decreased from 12954 Ωcm$^2$ to 20.5 Ωcm$^2$ and film capacitance ($C_f$) increased from 2.09×10$^{-5}$ Fcm$^{-2}$ to 2.3 ×10$^{-4}$ Fcm$^{-2}$.

**Keywords:** Admiralty Brass; Condenser; Thermal power plant; Corrosion

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A Study on the Corrosion Inhibition of Copper by Ethanolamines in the presence of BTAH

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## Abstract

The corrosion inhibition behavior of Monoethanolamine (MEA), Diethanolamine (DEA) and Triethanolamine (TEA) toward corrosion of copper in groundwater in the presence of Benzotriazole (BTAH) was investigated. DC polarization and AC impedance techniques with Open Circuit Potential (OCP) measurements utilized to evaluate the inhibition performance of the chemicals.SEM and XRD analysis were performed to study the surface changes of substrate. The stability of film layer on the copper surface in the corrosive media containing inhibitors was studied by EIS for different periods. The results showed a strong dependence of inhibitor performance with the structure of the inhibitor molecules. Increasing in the number of side branches caused a decreasing in the corrosion inhibition. Furthermore SEM images indicated that the surface of the metal was covered with a uniform film of corrosion inhibitors. The XRD pattern for the inhibited metal showed peaks with much diminished intensity corresponding to the minimal formation of $Cu_2O$.

**Keywords:** Corrosion inhibitor; Ethanolamine; copper; Electrochemical Polarization; Impedance, Benzotriazole

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Corrosion inhibition of mild steel in hydrochloric acid solution using ionic liquid and surfactant

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## Abstract

The corrosion inhibition of 1-hexyl-3-methylimidazolium chlorides (HMIm Cl), sodium dodecyl sulfate (SDS) and their mixtures on mild steel has been investigated in hydrochloric acid at different concentrations of the inhibitor using mass loss, potentiodynamic polarization and electrochemical impedance spectroscopy measurements. A significant decrease in the corrosion rate was observed in presence of the investigated inhibitors. The polarization curves showed that, the inhibitor behaves as mixed type but the cathodic effect is more pronounced. The surface tension at 298K was measured; the critical micelle concentration and some surface active parameters were calculated. The inhibition efficiency (η %) of inhibitors has been studied by electrochemical techniques at 25 ˚C. The observed corrosion data indicate that, the inhibition of mild steel corrosion is due to the adsorption of the inhibitor molecules on the surface. The adsorption mechanism onto steel surface in acid medium in the absence and presence of inhibitors was also discussed.

**Keywords:** Corrosion, Impedance, Ionic liquid, Surfactant

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Investigation of Self-Healing Coatings Based on Microcapsules Containing $CeO_2$ Nano Particles by EIS and EN Techniques

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## Abstract

Microcapsules with urea–formaldehyde as a shell, linseed oil as a healing agent and $CeO_2$ nano particles (NPs) were synthesized with diameters as small as 40–70 μm by in situ polymerization. The epoxy coating containing microcapsules were applied on carbon steels, and their self-healing effect was investigated in 0.5M HCl solution by optical microscopy, electrochemical impedance spectroscopy (EIS) and electrochemical noise (EN) techniques. For sake of an optimum self-healing system, two series of coatings prepared by using different microcapsule percentages by weight were noted as 5%, 10% and 20% with and without NPs. For comparison, a coating without microcapsules was also prepared. The experimental results demonstrate that the artificial scratches were successfully healed in about 2h after made. Furthermore, coating prepared from 10 wt% microcapsules containing $CeO_2$ NPs shows the best performance among all the prepared coatings.

**Keywords:** Microcapsule; Nano Particle; Electrochemical Noise.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Experimental investigation of 2-Methoxy-4-(2H-tetrazole-5-yl)phenol on the corrosion of Aluminium in 1M HCl

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## Abstract

The effect of addition of tetrazole derivatives on the corrosion of aluminium in 1M HCl solution is studied using weight loss measurements and electrochemical polarization methods. This study permits to follow the evolution of the inhibitive effect of tetrazole derivatives on aluminium in 1M HCl. Polarization measurements show that the tetrazole act as mixed inhibitors. The cathodic curves indicate that the reduction of proton at the aluminium surface happens within a pure activating mechanism. We note a good agreement between gravimetric and electrochemical polarization methods.

### Keywords

Tetrazole, Inhibitor, Aluminium, Corrosion, Electrochemical polarization

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4 , 5 December 2013

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# Mulberry as Green Corrosion Inhibitor of Steel in Hydrochloric Acid

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## Abstract

The known hazard effects of most synthetic corrosion inhibitors are the motivation for the use of some nature products as green inhibitors. Recently, plant extracts have again become important as an environmentally inhibitors. The inhibitory effect of this plant gum was studied on the corrosion of steel ST-37 in 1.0 M HCl using electrochemical polarization technique. The results show that by increasing inhibitor concentration, the corrosion current decreased. Also, with the increasing of inhibitor concentration, a noticeable shift of $E_{corr}$ toward cathodic value is observed which is consistent with the decreased current density in cathodic branch. When there is our inhibitor in the corrosive medium, anodic slope of the polarization curve is smaller than cathodic slope. This is because that, besides contributing to passivating layer formed on metal surface, and then inhibits the anodic dissolution of steel. The Tafel curves indicated that the plant extracts behave as mixed-type inhibitors.

**Keywords:** Corrosion; Green Inhibitor; Mulberry; Polarization

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Effect of surface nanocrystallization on corrosion of aluminum alloy treated by post plasma electrolytic oxidation

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**Abstract**

In this work, AA1230 aluminum alloy samples with and without surface mechanical attrition treatment (SMAT) were coated by PEO technique in phosphate- and silicate-based electrolytes and in presence of $Si_3N_4$ nanoparticles and morphology of the coatings was examined. To determine corrosion resistance of the coatings, potentiodynamic polarization technique was used. All coated samples were subjected to corrosion test to determine corrosion behavior of the coatings. These tests were carried out to compare coating properties of the samples subjected to SMAT operation before the coating, and also with those coated samples, without SMAT preprocessing. Then, the effect of SMAT preprocessing and its duration on properties of the coatings prepared by PEO were investigated. Samples subjected to SMAT have thicker coating compared to those without SMAT due to an increase in nanocrystalline matrix reactivity.

**Keywords: Aluminum; Corrosion; Plasma electrolytic oxidation; Nanocrystallization.**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Schiff base as corrosion inhibitor for aluminium in HCl solution

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## Abstract

inhibitive capability of Schiff base ligand 1,5-bis[2-(5-bromo- 2-hydroxy benzyl ideneamino)phenoxy on the aluminium corrosion in 0.1M HCl were investigated by means of electrochemical impedance spectroscopy, Tafel polarisation and scanning electron microscopy techniques. Results showed that, compounds under study exhibit inhibitor properties and adsorption of these compounds was found to accord with Temkin adsorption isotherm. Polarisation curves indicated that the studied Schiff bases were cathodic inhibitor. Impedance spectroscopy data sohwed that this compound increase the corrosion resistance of the electrode.

**Keywords: Schiff base, aluminium, cathodic inhibitor**

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# The Electrochemical Behavior of 304 Stainless steel in Alkaline Solutions in the Presence of Chlorides

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## Abstract

Nowadays, stainless steel reinforcements appear as an effective solution to increase the durability of reinforced concrete structures exposed to very aggressive environments. AISI 304 is widely used for this purpose. Although the improved durability of reinforcing AISI 304, when compared to carbon steel, there is a high probability of pitting susceptibility in the presence of chlorides. Thus, the present work aims at studying the passivation breakdown and semiconducting properties of AISI 304 in alkaline solutions of different NaCl content. The electrochemical behavior and semi conductive properties were evaluated by D.C potentiodynamic polarization, electrochemical impedance spectroscopy (EIS) and capacitance measurement (Mott-schottky approach). The results indicate that $Cl^-$ plays an important role in the evolution of the film resistance and charge transfer process. Moreover, the chloride ion induced change of the acceptor densities of the passive film.

Keywords: **Stainless steel; Alkaline Solution, Electrochemical impedance spectroscopy, Mott- schottky approach**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Passivity of 304 Stainless steel in Alkaline Solution by Mott-Schottky Analysis, EIS and Polarization Measurements

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## Abstract

Stainless steel reinforcements have proved to be one of the most effective methods to guarantee the passivity of reinforced concrete. AISI 304 is widely used for this purpose. The passivity of AISI 304 stainless steel in 0.2 M NaOH has been explored using D.C potentiodynamic polarization and, electrochemical impedance spectroscopy (EIS) and Mott-Schottky analysis. Based on Mott–Schottky analysis in conjunction with point defect model (PDM), it was shown that the calculated acceptor density decreases exponentially with increasing passive film formation potential. These observations were consistent with the predictions of the PDM, noting that the point defects within the passive film are cation vacancies; the thickness of the passive film was changed with the formation potential.

Keywords: **Stainless steel reinforcements, Potentiodynamic polarization, Mott–Schottky analysis**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Effect of Redox Potential on the thermophilic Bioleaching of Chalcopyrite

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## Abstract

Chalcopyrite is an extremely important copper mineral, and is also the most abundant copper bearing mineral in the world. It is known that the bioleaching process of chalcopyrite, often consist of series of oxidation-reduction reactions which could be described as an electrochemical dissolution or electrochemical corrosion process. The main problem in chalcopyrite leaching is passivation of the mineral surface. The passive layer could be formed by accumulation of elemental sulfur, polysulfide or jarosite. In bioleaching, bacteria oxidize elemental sulfur to sulfate which prevents the accumulation of elemental sulfur on the mineral surface. On the other hand, bacterial oxidation of Iron regenerates ferric Ion as the main oxidizing agent, which results in high solution potential. In this study, bioleaching of chalcopyrite by the thermophilic *Acidianus brierleyi* was studied. All tests were carried out in Erlenmeyer flasks in a rotary shaker at 120 rpm and constant temperatures of 60 °C. The effect of Solution oxidation-reduction potential (ORP) on the bioleaching of chalcopyrite, was discussed. Also, effect of bacterial activity, solution pH, ferric Ion concentration and pulp density on the redox potential of the bioleaching solution was investigated.

**Keywords:** Chalcopyrite; bioleaching; Acidianus brierleyi; Redox potential

**9th Iranian Annual Seminar of Electrochemistry**

**4 , 5 December 2013**

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# Synthesis, characterization and thermal properties of $Fe_2TiO_5$/ cellulose and cellulose acetate nanocomposite

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## Abstract:

In this study**,** cellulose and cellulose acetate / $Fe_2TiO_5$ nanocomposite have been synthesized successfully. cellulose /$Fe_2TiO5$ nanocomposite indicate a ferrimagneticparamagnetic behavior, as evidenced by using vibrating sample magnetometer(VSM) at room temperature. Fourier transform infrared spectrometry (FTIR), scanning electron microscopy (SEM) and Simultaneous thermal Analysis (STA) respectively, to characterize,diagnosis, morphology and particle size, and to measure the thermal properties of samples were used. STA investigations reveal that the thermal stability of the cellulose and cellulose acetate is significantly enhanced with the addition of nanofillers. The results indicated that $Fe_2TiO_5$ nanopowders were distributed in cellulose and cellulose acetate matrix with particle size between 25 and 75nm.

**Keywords:** cellulose acetate,nanocomposite, polymer, sol-gel Synthesis

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthesis, Characterization and Thermal Properties of $Fe_2TiO_5$/polyaniline Nanocomposites

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## Abstract

Polyaniline-Iron titanate nanocomposites (NCs) with two contents loading of $Fe_2TiO_5$ were successfully synthesized by sol gel technique. FTIR, XRD, SEM and STA were used to characterize the structure of the obtained NCs. The results indicated that $Fe_2TiO_5$ NPs with particle size between 25 and 75 nm were distributed in PANI matrix. STA analysis indicates better thermal stability of the NCs than that of pure PANI and the terminal degradation temperature of NCs (670°C) are greater than the PANI/$Fe_3O_4$ NCs (570°C).

**Keywords:** nanocomposite; $Fe_2TiO_5$; thermal properties

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Effect of Carbon nanotubes on the Electrical Conductivity of Polyurethane/Multiwalled Carbon nanotubes Foam

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## Abstract

This article demonstrates the effect of addition of carbon nanotubes (CNT) on the electrical conductivity of polyurethane foam. Three types of CNT namely pristine, and modified with carboxylic and amine groups were incorporated in foams. The effects of different parameters such as weight percent of the carbon nanotubes and the type of functional groups on electrical conductivity were investigated. According to scanning electron microscope (SEM) observations modification of CNT with amine group improved the CNT dispersion in the foam matrix. Also it was found that incorporating all CNT types can effectively increase electrical conductivity of nanocomposite. However, the pristine CNT showed to be more effective than the ones modified with carboxyl and amine groups. For example, addition of 0.5 wt% of pristine CNT could increase the electrical conductivity up to tenfold. These results were interpreted by discussing the dispersion patterns of different types of carbon nanotubes in polyurethane foam matrix.

## Keywords

Electrical Conductivity, Foam, Polyurethane, carbon nanotubes

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthesis and electrical characterization of polyaniline / multiwalled carbon nanotubes / resin epoxy composite

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## Abstract

Polyaniline (PANI) is a conductive polymer may be used in electronics, sensors and anti-corrosion coating fabrication. However, its brittleness and poor mechanical properties limits such application. In order to improve the mechanical properties of PANI, one may implement it in polymeric composites such as epoxy resin (ER).

In this study, first PANI / carbon nanotubes (CNT) composite was fabricated by a simple electrochemical method. The resultant composite was milled and dispersed in ER and cured by its hardener to fabricate PANI / CNT / ER composite. Also CNT modified with amine and carboxylic functional groups were used to achieve a better dispersion into the ER matrix and the results were compared with those of pristine CNT. It was found that the electrical conductivity of the samples produced with modified CNT is more than the samples produced using pristine ones. Also amine functional groups were more effective than carboxyl functional groups in enhancing the composite conductivity. This may be related to better dispersion of amine modified CNT in the composite.

## Keywords

Electrical Conductivity, Epoxy, Polyaniline, Carbon nanotubes

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Effect of Ionic liquid on Electrical Conductivity of Epoxy resin/CNT Nanocomposites

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## Abstract

Carbon nanotubes (CNTs) with superior electrical conductivity have been used for improving the electrical properties of polymer composites. Modification of CNTs by ionic liquids (ILs) due to (cation-$\pi/\pi$-$\pi$) interaction between CNTs and ILs improves the networking of tubes in polymer and increases their electrical conductivity. In this work, the effect of IL on DC conductivity of carbon nanotubes/epoxy resin composites with DC conductivity measurement of unmodified and IL modified CNTs composites are studied. The DC conductivity of modified CNT composites at a constant loading of CNTs (0.3%) is enhanced with increasing the concentration of IL until a critical point (15% IL) and after that it is reduced. At low concentration of IL (lower than 15%), IL droplets are coated by CNTs and they make the nano tubes close together and the conductivity is improved. On the other hand, at higher concentrations of IL, droplets are dissolved nano tubes and it causes reduction in electrical conductivity.

**Keywords: Carbon nanotube; Ionic liquid; Epoxy resin; Electrical conductivity**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electron transport of GaN nanoribbons using non-equilibrium Green function

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## Abstract

Gallium Nitride is a promising semicondutor material for optoelectroninc applications due to its large(3.5ev)ban gap.We address electron transfort in GaN nanoribbons with armchair edges attached to tow semin-infrinite three-dimensional metallic electrodes within the tight-binding framework. Here we present numeically the current-voltage and transimision-energy charactries as function of the length of the nanoribbons.our theoritical results predict that a gap in the transimision spectrum appears across the energy E=0. The transport properties are discussed in the aspects of molecule-to-electrode coupling strength one is weak-coupling and other one is strong coupling limit.

Keywords: tight-binding, non-equilibrium Green's function, GaN nanoribbons.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Plasmonic photocatalyst system using Ag/AgBr/mordenite nanocrystal under visible light

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## Abstract

In this paper, plasmonic photocatalyst nanostruct ure system was investigated on Ag/AgBr/mordenite nanocrystal under visible light. Silver nanoparticles were readily prepared using dispersing agent and calcinations. The X-ray diffraction analysis (XRD) and diffuse-reflectance spectro scopy (DRS) demonstrated that silver bromide were introduced on the surface of mordenite nanocrystal and then Ag nanostructured photocatalytic materials were successfully synthesized. The silver nanoparticles plasmonic photocaalysts exhibited the enhanced photocatalytic performance over mordenite nanocrystal. The photocata lytic activity and stability of the synthesized catalysts were evaluated for methylene blue (MB) degradation in aqueous solution in the presence of 60 W tungsten filament Philips lamp. Several parameters were examined, catalyst amount, pH and initial concentration of MB, AgBr loading. The support size was obtained about 100–150 nm. In the same w ay, the average size of silver nanoparticles was obtained about 8 nm, before visible radiation. After visible radiation the average size of Ag nanoparticles was about 30 nm.

**Keywords:** Plasmon photocatalyst; Mordenite nanocrystal; Silver nanoparticles; X-ray diffraction

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Aqueous synthesis and characterization of CdS quantum dots capped with some amino acids and investigations of their photo catalytic activities.

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## Abstract

The present study examines the influence of some amino acids such as alanine, histidine and serine as stabilizers in the synthesis of CdS quantum dots. The optical properties of the synthesized CdS QDs, including the UV–visible absorption and photoluminescence (PL) spectra, were studied. The UV–Vis & PL emission spectra of the CdS QDs exhibited a broad absorption band from 200-800 & the sharp PL emission peak with the maximum wavelength of His-CdS, Ser- CdS & Ala-CdS are 522nm, 518nm and 524nm ($\lambda_{ex}$= 343nm), respectively. Moreover, the CdS QDs showed strong photocatalytic degradation activities for organic dyes such as alizarin under visible light irradiation (sunlight). Herein, the photocatalytic efficiencies of Ser-CdS, His-CdS and Ala-CdS were calculated to be 98%, 96% and 90% with an increase in their size, respectively, which are significantly higher than that of bulk CdS (12.7%).

**Keywords:** Quantum dots, Photo catalysis, Cadmium sulphide, Stabilizer.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Investigation of the Inhibition of Copper Corrosion by Thioridazine Self-assembled Film

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## Abstract

In this work the inhibition efficiency of Thioridazine as an antipsychotic medication have been investigated against corrosion, in sodium chloride 3.5% solution by electrochemical and scanning electron microscopy methods. The results of the polarization curves demonstrate that the films of the Thioridazine are able to protect the copper from corrosion effectively in sodium chloride media. When the copper surface is modified by thioridazine, the corrosion resistance is significantly increased. The polarization results indicate that the maximum inhibition efficiency of Thioridazine reach 92.5%. The effect of the temperature shows that the inhibition efficiency increases by increasing the temperature.

**Keywords: Copper; Polarization; Self-assembly; Corrosion**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Green Approach to Corrosion Inhibition of Copper in Acidic Solution by the Extract of *Calligonum Comosum*

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## Abstract

Most of the well-known acid inhibitors are organic compounds showed an effective corrosion inhibition. they are expensive and toxic for live beings, so development novel corrosion inhibitors of plant extract [1, 2]. Corrosion inhibition effect of calligonum comosum extract on copper in 2M HCl medium has been investigated by potentiodynamic polarization and electrochmical impedance spectroscopy (EIS) methods. Maximum inhibition efficiency (80.06% in 2 M HCl) is obtained at 800 ppm calligonum comosum extract at 25º C. The polarization studies showed that calligonum comosum extract acts as mixed type inhibitor. Electrochemical impedance spectroscopy was used to investigate the mechanism of corrosion inhibition. The Nyquist plots show an increase of the transfer resistance with increasing the inhibitor concentration and decreases double layer capacitance. The temperature effect on the corrosion behavior of copper in 2 M HCl without and with the inhibitors was studied in the temperature range from 35 to 65º C. The results showed that the inhibition efficiency of this extract increase from 61.8 to 86.7 percent with increasing temperature from 35 to 25°C. This result emphasize that the inhibitor are chemical adsorbtion at high temperature. The inhibition action of the extract was discussed in view of langmuir adsorption isotherm. The calligonum comosum extract being a natural and environmentally benign product it can be used as an alternative for toxic chemical inhibitors in acidization and acid pickling of copper.

**Keywords:** Corrosion inhibition; Copper; Calligonum comosum extract

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Investigation of anodic oxidation of PAN-based carbon fibres in NaOH and $HNO_3$ electrolytes

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## Abstract

Carbon fibres have been widely used as reinforcement in high-performance composite because of its preeminent mechanical strength, low density and thermo and chemical stability. Its inert surface makes itself only possessing lower interfacial bounding strength with sounding resin matrix and requires a suitable surface pretreatment. Electrochemical oxidation treatment is the most effective technique for this purpose. The type and amount of the functional groups formed depend on the type of the electrolyte, its concentration, treatment time, and voltage. The proper selection of the conditions of electrochemical oxidation is essential for achieving optimum composite properties. In this study, the surface of the carbon fibres was treated by constant voltage in different electrolytes such as: NaOH and $HNO_3$. Some effective parameters on oxidation process such as type and concentration of electrolyt and oxidation time was investigated. The anodic behavior of Carbon fibres was also investigated by the cyclic voltammetry method in mentioned solutions. The surface chemistry of the oxidized carbon fibre was studied by ATR-FTIR and EDX.

**Keywords:** Polyacrylonitrile-based carbon fibre; Various electrolytes; anodic oxidation; Cyclo-voltammetry

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Investigation of anodic oxidation of PAN-based carbon fibres in NaOH and $HNO_3$ electrolytes

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## Abstract

The surface of the polyacrylonitrile-based carbon fibres was treated in different electrolytes such as: NaOH, and $HNO_3$ by electrolytic oxidation and chemical coupling, because in the industrial practice electrochemical oxidation process is used for functionalization. Some effective parameters on oxidation process such as type and concentration of electrolyt and oxidation time was investigated. The anodic behavior of carbon fibres was also investigated by the cyclic voltammetry method in mentioned solutions. The surface chemistry of the oxidized carbon fibre was studied by ATR-FTIR and EDX. Finally, the anodic behavior of polyacrylonitrile-based carbon fibres was compared in these electrolyte systems.

**Keywords:** Polyacrylonitrile-based carbon fibre; Various electrolytes; anodic oxidation; Cyclo-voltammetry

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Effects of 2,3-dihydroxy (3-hydroxyphenyl) aldimine on copper corrosion as a corrosion inhibitor in acidic solution

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**Keywords: inhibitor; copper; polarization**

A new corrosion inhibitor 2,3-dihydroxy(3-hydroxyphenyl)aldimine has been synthesized and its inhibition on copper in 6.0 M hydrochloric acid has been investigated.
Corrosion inhibition was studied by polarization method and electrochemical impedance spectroscopy.
The results show that this compound is good inhibitor in acidic media and the inhibition efficiency at the highest concentrations ($5\text{-}10^{-3}$ M) is %91. The result from polarization show that the presence of inhibitore in more negative potential as well as decreasing the both anodic and cathodic current densities, while it seems that the cathodic current densities decrease is more pronounced.
most of the displacement in $E_{corr}$ value is 180 mV, therefore, we can conclude that inhibitor is a cathodic type. Impedance measurement showed that the charge transfer resistance enlarged and double layer capacitance reduced with increasing in the inhibitor's concentration. Obtained results about inhibition efficiency from polarization study and impedance are in good agreement with each other.

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9th Iranian Annual Seminar Electrochemistry

4 , 5 December 2013

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# Growth and Wettability of Micro-arc Oxidized MgO-based Nanocomposite Coating

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## Abstract

Surface of AZ31B magnesium alloy was nanocrystallized using the surface mechanical attrition treatment. Then, micro-arc oxidation was carried out on nanocrystallized and coarse-grained surfaces in a phosphate-based suspension with and without titania nanoparticles. In this research, surface morphology of the obtained coatings was investigated using the scanning electron microscope. Besides, for analysis of the porosities on the coatings, the image analysis software and wettability test were used. To examine the effect of nanocrystallization on the energy needed for micro-arc oxidation process, potential-time diagram of the coating process was used. The results indicate that the energy needed for coating process on the surface of nanocrystallized samples is lower than that of coarse-grained samples. Moreover, the wettability tests results indicated that there is no clear relationship between surface porosities and internal porosity of the coatings. Also, SMAT pre-process resulted in a decrease in the volume and free surface of the porosity inside the coating.

**Keywords:** Magnesium; Micro-arc oxidation; Nanocomposite; Wetting test.

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Turmeric and Pepper as Green Corrosion Inhibitors forCopper in $H_2SO_4$

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## Abstract

The use of green inhibitors is an effective ways of protecting metals and alloys against corrosion. The green corrosion inhibitors are biodegradable and do not contain toxic compounds. This work is trying to investigate inhibiting effect of turmeric and pepper on corrosion of copper in 1M H2SO4 solution by weight loss and electrochemical methods. In weight loss method, the copper specimens have been immersed in test solutions for a period of 1 month. The electrochemical study is done by potentiodynamic polarization technique. The results have shown that turmeric and pepper act as corrosion inhibitor for Cu.

**Keywords:** Turmeric, Pepper, Copper, Green Corrosion Inhibitor

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University of Tarbiat Modares, Tehran, Iran

# Electroplating Nano Crystalline Nickel for Reduction of Corrosion rate

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## Abstract

The main objective of the present study is to synthesize a nanocrystalline (22nm-25nm) coating based on Nickel over the yellow-brass plates. To do this, an electroplating technique in a modified Watts bath is employed in which the current density and stirring speed varied between 3 to 9.5 A/dm$^2$ and 0 to 600 rounds per minute (rpm), respectively. In order to determine the grain size of the coating, X-ray diffraction (XRD) technique is used. It is observed that increasing the current density and then stirring speed resulted in reducing the grain size. In addition to this, and according to the slope of the linear equation, a Tafel slope of 0.4140 V is calculated which illustrates a very rational relationship among electrochemical systems. Moreover, the electrochemical behavior of the electroplated samples is investigated using a polarization test in a solution of NaCl 3.5%. The results showed that for those samples that have been prepared in a non-stirring system, it is hard to find a specific correlation between corrosion rate and crystallite size as well as current density. Therefore, the best corrosion resistance as much as 5 A/dm$^2$ is measured. On the contrary, when increasing stirring speed induced turbulent behavior to the solution, the corrosion resistance decreased and therefore the corrosion rate in the polarization test increased. It was not also observed a significant passive behavior through the potentials higher than the corrosion potentials which could be attributed to the weak and defective nature of the passive layer over the surfaces of the electroplated Nickels.

**Keywords:** Coating, polarization, Nickel nanocrystalline, Grain size, Corrosion

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9th Iranian Annual Seminar of Electrochemistry

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# Electroplating Nano Crystalline Nickel for Increasing of Hardness

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## Abstract

The main objective of the present study is to synthesize a nanocrystalline (22nm-25nm) coating based on Nickel over the yellow-brass plates. To do this, an electroplating technique in a modified Watts bath is employed in which the current density and stirring speed varied between 3 to 9.5 Ampere per square Decimeter ($A/dm^2$) and 0 to 600 rounds per minute (rpm), respectively. In order to determine the grain size of the coating, X-ray diffraction (XRD) technique is used. It is observed that increasing the current density and then stirring speed resulted in reducing the grain size. In addition to this, hardness of the specimens is measured by a Vickers Microhardness machine at the loading of 25 gr. Based on the hardness results, the higher current density and the finer crystal grains showed the higher hardness of the specimens. But, the more turbulent behavior in the solution, the lower hardness observed. Hardness reduced in stirred systems with increasing turbulence and reducing crystallite size, possibly due to the formation of bubbles of diameter 80nm until 130nm on the coating (Based on SEM images). The relationship between grain size and microhardness is similar to what was proposed by Hall-Petch, but not when there is turbulence in the system.

**Keywords:** Electroplating, Nickel nanocrystalline, Grain size, Hardness

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Ephedra Sarcocarpa extract as Green Corrosion Inhibitor for Copper in Acidic Media

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## Abstract

some methods and compounds have been used for corrosion protection of metal in corrosive solution, such as using of acid inhibitors are organic compounds especially those with N, O and S showed an effective corrosion inhibition and organic self-assembled monolayer. Recently development of a novel corrosion inhibitor of plant extracts has attracted some attention as safe to the environment corrosion inhibitor for many decades [1, 2].

Corrosion inhibition effects of ephedra sarcocarpa extract on copper (Cu) in 2 M HCl medium has been investigated by potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) methods. The polarization studies showed that ephedra extract acts as cathodic inhibitor and maximum inhibition efficiency (94.5% in 2 M HCl) is obtained at 0.5 g/l ephedra sarcocarpa extract at 298 K. The Nyquist plots show an increased of the transfer resistance with increasing the inhibitor concentration and decreases double layer capacitance. The temperature effect on the corrosion behavior of copper in 2 M HCl without and with the inhibitors was studied in the temperature range from 35 to 65°C. The results showed that the inhibition efficiency of this extract increase from 75.9 to 81.5 percent with increasing temperature from 35 to 65°C. This result emphasize that the inhibitor are chemical adsorbtion in high temperature. The inhibition action of the extracts was discussed in view of Langmuir adsorption isotherm. SEM images confirmed the adsorption of ephedra on copper surface. Finally, ephedra sarcocarpa extract act as a good corrosion inhibitor for copper in 2 M HCl medium

**Keywords:** Corrosion; Copper; ephedra sarcocarpa extract, EIS

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4 , 5 December 2013

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# Electrodeposited Poly(*O*-anisidine) Coatings on Aluminum Alloy 5052: Synthesis,Characterization and Corrosion Protection Evaluation

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## Abstract

Over the years, various protection methods have been developed to prevent the degradation processes of Al and its alloys. The application of organic coatings is a good way of taking advantage of the mechanical properties of the metal, while protecting it from corrosion. In this study, the corrosion protection ability of electropolymerized poly(O-anisidine) (POA) coating on aluminum alloy (AA) 5052 has surveyed . The synthesized coatings were characterized by reflection absorption infrared (RAIR) spectroscopy, UV–visible absorption spectrometry and scanning electron microscopy (SEM) . The anticorrosion performances of POA coatings were investigated in 3.5% NaCl solution by the potentiodynamic polarization technique and electrochemical impedance spectroscopy (EIS). The obtained results revealed that the POA coating acts as a corrosion protective layer on AA 5052 in 3.5 wt% NaCl solution. The corrosion rate of the POA-coated Al was found to be about 100 times lower than that observed for uncoated Al.

**Keywords:** Aluminum alloy 5052, Poly(o-anisidine), Electrochemical synthesis, Corrosion, EIS

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4 , 5 December 2013
University of Tarbiat Modares, Tehran, Iran

# Electrochemical determination of Simvastatin using pyrolytic carbon electrode in pharmaceutical formulation

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Simvastatin is a hypolipidemic drug used with exercise, diet and weight-loss to control elevated cholesterol or hypercholesterolemia. It is a member of the statin class of pharmaceuticals. A rapid, simple and sensitive voltammetric method has been developed for the determination of Simvastatin based on using pyrolytilic carbon electrode. Its simplicity makes the method suitable for routine analysis in control laboratories. Pyrolytic carbon(pyrocarbon) electrode was prepared duration of chemical vapor deposition (CV) process flowing of methane and nitrogen gases in atmospheric pressure and 1100◦C temperature through a quartz reactor and deposition on graphic cylinder as a substrate. During this processes, a thin film of pyrocarbon was formed on graphite. The pyrocarbon coated was identified using Raman, X-ray diffraction (XRD) and scanning electron microscopy (SEM) techniques. Optimum conditions of pH, ionic strength, scan rate, potential magnitude and analyte concentration for the development of the method were established using cyclic voltammetry and differential pulse voltammetry. Linearity was observed in the concentration range of 1-10 µg mL-1. The relative standard deviation was obtained 1 % for simvastatin. The percentage recovery of simvastatin tablets was obtained 98%.

Keywords:
Simvastatin - electrochemical determination – pyrocarbon- pharmaceutical preparations

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# A New Aflatoxin B1 Biosensor Based on Bi-Enzymes Covalently Immobilized on Self-assembled Monolayer on Gold Electrode

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## Abstract

A new electrochemical biosensor based on the covalent immobilization of two enzymes on self-assembled monolayer attached to a polycrystalline gold electrode is proposed, experimentally. The acetylcholinesterase (AChE) and cholineoxidase (ChO) are two enzymes that covalently co-immobilized on the mercaptopropionic acid self-assembled monolayer on polycrystalline gold electrode (Au-MPA-AChE/ChO SAM). At the first gold electrode surface was precisely polished with fine alumina powder suspension and then self-assembled monolayer of 3-mercaptopropionic acid (MPA) was formed on the cleaned gold electrode surface. Then the MPA acidic head groups were activated by some chemical activator reagents to enable the reaction with amine functional groups of the enzymes and covalently immobilization performed. Fabrication steps and electrochemical interaction of the Au-MPA-AChE/ChO SAM with AFB1 were monitored by general electrochemical methods like cyclic voltammetry (CV) and chronoamperometry (CA).

**Keywords**

Electrochemical Biosensor, Aflatoxin B1, Self-Assembled Monolayer, Cyclic Voltammetry, Chronoamperometry.

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Effect of SMAT pre-Processing on MAO-Fabricated Nanocomposite Coating on AZ31B Magnesium Alloy

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**Abstract**

Micro-arc oxidation is among the novel techniques applied for coating the surface of light alloys for fabrication of oxide coating through applying high voltages. The role of fine microstructure state of the metallic substrate on morphology and properties including corrosion resistance of the coating formed using this technique on AZ31B magnesium alloy was investigated. Surface nanocrystallization was carried out through the surface mechanical attrition treatment and a nanostructure with grain size of 5 to 10 nm was obtained. Nanocomposite coatings fabricated in a bath containing alumina nanopowders and were studied by optical microscope and scanning electron microscopy and transmission electron microscope images and the corrosion tests were conducted on the samples. A comparison between the maximum and minimum obtained results for the polarization resistance indicated an 800 times increase for different coating conditions.

**Keywords:** Magnesium; Corrosion; MAO; SMAT; Nanocrystalline metal; Nanostructure.

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrodeposition of Platinum on Semiconductor Electrode in Molten Salt Media and Its Catalytic Applications

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## Abstract

Metal deposition on semiconductors is an important step in microelectronics. Among the techniques used, potentiostatic pulsed electrodeposition offers unique opportunities for easy control of the structure and morphology of deposits by simply changing parameters [1]. Platinum have proven to be the best monometallic catalysts for the oxidation of ethanol in alkaline media [2]. This paper presents pulse potential electrodeposition of platinum nanoparticles on fluorine tin oxide (FTO) and tin oxide from $AlCl_3$-NaCl molten salt containing $K_2PtCl_6$ at 393K. The results showed that by optimizing the deposition parameters including the on potential ($E_{on}$), off potential ($E_{off}$), on time ($t_{on}$) and duty cycle (DC) we are able to improved catalytic performance of modified electrode for ethanol electrooxidation. The prepared Pt@$SnO_2$ can also be used as a gas sensor and its gas sensing properties were tested for response to ethanol gas. The Pt@$SnO_2$-based sensor exhibited an improved response for ethanol compared to the $SnO_2$ material.

**Keywords:** Platinum; Pulse Electrodeposition; Ethanol sensing

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Corrosion protection of Steel by Chemically and Electrochemically Deposited Polyaniline/Silica Nanocomposites

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## Abstract

Over the last few decades, many researches have been done on corrosion protection of metals based on polymeric coatings. In this study, 316L stainless steel was coated by polyaniline and polyaniline/silica nanocomposite using electrochemical and chemical methods. In the electrochemical approach, the polyaniline was deposited on stainless steel by cyclic voltammetry. In chemical approach, coatings were synthesized using ammonium persulfate and deposited on steel surface by organic solvents. The synthesized coatings were then characterized by FTIR spectroscopy, thermogravimetric analysis (TGA) and scanning electron microscopy (SEM). The corrosion behaviors of the coated and bare steels were studied in 1 M sulfuric acid using electrochemical impedance spectroscopy (EIS) in terms of charge transfer resistance ($R_{ct}$). It was found that addition of 0.22% monodisperse silica nanoparticles (70 nm) improve corrosion protection behavior of polyaniline coatings by a factor of 97% and 93% in chemical and electrochemical approaches, respectively. Finally, chemically deposited coatings exhibited higher corrosion resistance relative to electrochemically deposited coatings, particularly in longer times up to 72 h.

**Keywords**

Polyaniline, Corrosion protection, Stainless steel

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electro-oxidation of Hydrazine Catalyzed by the Porous Nanostructured Ni/AuNi Electrode

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## Abstract

The electrocatalytic oxidation of hydrazine at a porous nanostructured Ni/AuNi electrode was studied by cyclic voltammetry, chronoamperometry and electrochemical impedance spectroscopy techniques in alkaline medium. The Ni/AuNi nanostructured electrode was prepared firstly by the electrodeposition of Ni-Zn on the Ni coating, followed by subsequent replacement of the zinc by gold at open circuit potential in a gold containing alkaline solution. The surface morphologies and compositions of coatings were determined by scanning electron microscopy and energy dispersive X-ray techniques. The results showed that the Ni/AuNi coatings were porous composing of discrete Au nanoparticles. In CV measurements, the electro-oxidation current on Ni/AuNi catalyst was much higher than that on flat Au catalyst. The onset potential and peak potential on Ni/AuNi catalysts were more negative than those on flat Au catalyst for hydrazine electrooxidation. All results show that the Ni/AuNi catalysts can be applied as potential catalysts for the direct hydrazine fuel cells.

**Keywords:** Electrocatalyst; Hydrazine electrooxidation; Galvanic replacement; Cyclic voltammetry; Direct hydrazine fuel cell; Electrochemical impedance spectroscopy

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthesis, Characterization and investigation of *nitrilotriacetic* acid (NTA) using cysteine on gold electrode surface

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## Abstract

In situ functionalization of a cysteine (Cys) self-assembled monolayer (SAM) on a Au electrode (Cys/Au SAM) by the nucleophilic substitution reaction is considered. for synthesis of Nitrilotriacetic acid (NTA), first, Cys is chemisorbed on Au electrode, then the terminal functional groups on the surface of a SAM (NH2 group) can react directly with the Bromoacetic acid in solution. Electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV) are employed to characterize the modification steps. Self assembled monolayers (SAMs) have been described as a spontaneous, coordinated chemical interaction of individual molecular building blocks to create a stable, highly ordered and densely packed single layer of molecules from a solution or a gas phase onto a substrate. Over the past two decades, SAMs have received extensive attention due to their stability, simple formation and potentiality of application in many fields such as sensor and biosensor construction, studies of charge transfer kinetics, resistance to corrosion, molecular electronics, biomolecular electronic devices, immobilization of biocatalyst, drug delivery, and trace ion determination. Electrode modification through the self-assembly process profits from chemical specificity, rapid response, high sensitivity, antifouling effect, and possibility for in-situ immobilization of biological recognition agents (e.g., enzymes).

NTA is a tetradentate ligand which occupies four of the six binding sites of $Ni^{2+}$, leaving two free sites for His-tag proteins to bind.Transition metals chelated by NTA or other chelators were successfully applied for the purification and detection of oligohistidine-tagged proteins, as well as for surface immobilizations and for tethering to lipid membranes.

**Keywords:** synthesis, Cysteine, Self-assemble monolayer, nitrilotriacetic acid, gold electrode

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Controlable Synthesis of Anodic Aluminium Oxide Template for Preparing of One Dimensional Nanostructures

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## Intruduction

In the recent years, nanoscale materials, especially one dimensional nanostructures, have attracted extensive attentions [1]. For achieving such nanostructures one of the simplest methods is electrochemical fabrication of nanostructures on anodic aluminium oxide template. AAO is a self-ordered nanoporous template that consist of a hexagonal array of cells with uniform and parallel straight cylindrical nanopores perpendicular to the template surface. AAO templates can be obtained easily by a two-step electrochemical anodization [2]. In this study, by using the SEM technology effect of anodizing potential on structure of anodic aluminium oxide template was investigated.

## Materials and method

A highly pure aluminium foil (99.999%) was annealed at 500°C for 10h, then degreased in acetone ultrasonically for 10min. samples were electropolished in a 1:4 volume mixture of percholoric acid and ethanol at 20V. The different samples of aluminium film were anodized in a 0.3M oxalic acid solution at 30, 40, 50V for 20h at constant tempreture of 6°C. After anodization a preliminary oxidation layer was removed by immersing the sample in the mixture solution of $H_3PO_4$ (6wt%) and $CrO_3$ (1.8%). The second anodization was carried out in same conditions of first anodization for 1h.

## Results and Discussion

By comparing Figs 1,2,3 understood that by enhancing the anodizing potential the diameter of the pores were increased. Fig 1 shows AAO template which preapared at 30V so, the size of the pores is smaller than the size of pores in Fig 2 and 3, also the pore density was affected by anodizing potential for instance, pore density in Fig 1 is more than it in the film that anodized at 40 or 50V. Another fact that happend is the destruction of the structure in high potential, actually the loss of higher-order structure were observed Fig 3.

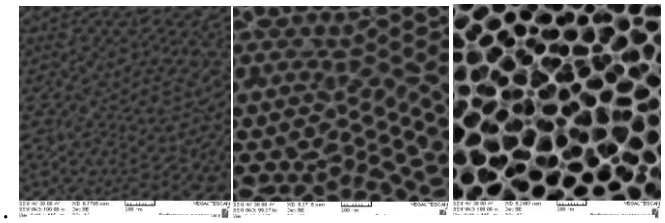

Fig1: 30V Fig2: 40V Fig2: 50V

## Conclusions

To sum up, by enhancing the anodizing voltage size of pores increase and the template become less ordered.

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9th Iranian Annual Seminar of Electrochemistry

4,5 December 2013

University of Tarbiat Modares, Tehran, Iran

# DPPH radical scavenging activity of polyaniline/graphene nanocomposite modified electrode prepared in phosphoric acid medium

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## Abstract

Electrodeposition of polyaniline/graphene (PANI/Gr) nanocomposite on the composite 2B pencil graphite (CG) from a phosphoric acid (solvent) and calcium chloride (supporting electrolyte) medium is performed. FT-IR and UV-Visible spectrums (Figure 1) indicate that the increase in molar ratio of PANI in nanocomposite has increased the antioxidant activity of composite. The antioxidant activity is investigated through reaction with 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical in methanol. Additionally, the electrochemical impedance spectroscopy (EIS) shows that the increase of molar ratio of PANI in nanocomposite has also increased the charge and mass transfer.

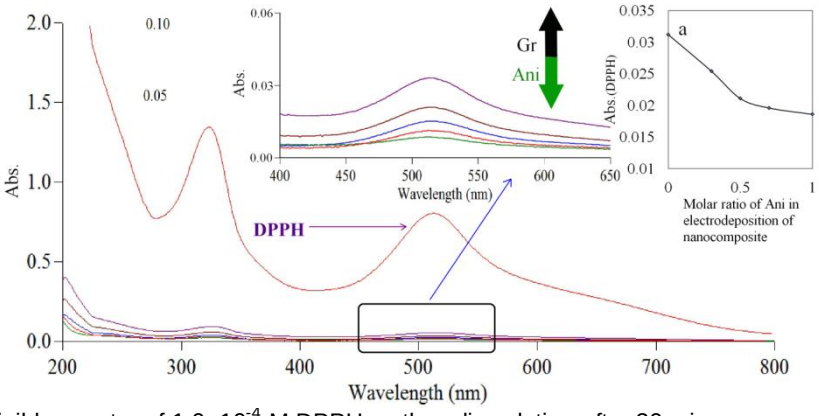


**Fig. 1** UV-visible spectra of $1.0\times10^{-4}$ M DPPH methanolic solution after 30 min exposure to PANI/Gr nanocomposite electrosynthesized with different molar ratio of ANI. Absorbance of DPPH in the absence of PANI/Gr nanocomposite is 0.84. Inset (a) shows the plot of Absorbance (at 516 nm) *vs.* molar ratio of ANI.

**Keywords**: Antioxidant activity; Free radical scavenging; Impedance spectroscopy; Polyaniline; Phosphoric acid.

9th Iranian Annual Seminar of Electrochemistry

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# Evaluation of cathode material effects on methanol reductive production from carbon dioxide and formic acid; mechanistic and electrocatalytic features

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## Abstract

In this comparative study, the effect of cathode material on selectivity and current efficiency of MeOH reductive production from $CO_2$ and HCOOH was investigated. The reduction of $CO_2$ and HCOOH on Cu, $Cu_2O$-deposited on stainless steel, Sn and Pb were accordingly achieved. To surmount on kinetic difficulties of $CO_2$ reduction on Pt and facilitate the six electron transfer process in producing MeOH, pyridine as a very effective electron mediator was employed. This study has also justified that homogeneous electron transfer-mediated of $CO_2$ reduction is much more favorable in energy point of view, so it can be done in lower overvoltage.

**Keywords:** methanol, electron mediator, cathode material

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# Synthesis of Bi-2212 superconductor nano particles by electrodeposition process

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## Abstract

In this research, Bi-2212 superconductors have been prepared by electrodeposition process. Silver, cupper and stainless steel are used as cathode. For each of them the electrodeposition conditions (such as temperature and voltage) are optimized and determined. The samples have been annealed by heating to 800 $^{o}$C by three paths. The obtained Bi-2212 superconductors are characterized by Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD) and critical transition temperature ($T_C$) tests. Nano-leaf and nano-particles structures are obtained according to the heat treatment path. The results show that the transition temperature of the best sample is ~85 k.

**Keywords:** Electrodeposition; Bi-2212; Superconductor; $T_c$

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# Electrochemical Study of the MCM-41 Supported NHPI as Catalyst for Green Oxidation of Alkylbenzenes

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## Abstract

Activation and/or oxidation of alkylbenzens are one of the most important chemical transformations involved in many areas of chemistry. Numerous studies have been attempted to present the green oxidation routes for this fundamental oxidation. Among them, catalytic oxidation using molecular oxygen in the presence of N-hydroxyphthalimide NHPI as key catalysts is one of the outstanding routes in environmentally benign transformation of alkyl benzens.[1] NHPI as an efficient and green organocatalyst, undergoes also electron transfer at the electrode surface. Same as the chemical oxidation, the product of electrochemical oxidation is also a desired reactive radical which known as PINO. The redox activity in combination with good catalytic performances can be used in electrocatalytic oxidation of alkylbenzenes. The first aim of this study is the voltammetric analysis of the oxidation of alkylbenzenes by electrogenrated PINO. Voltammetric studies of NHPI/PINO redox couple have been studied in the absence and presence of various types of alkylbenzenes. The results showed that the oxidation of NHPI followed by a slow and pH dependent degradation reaction (EC mechanism). The degradation reaction slows down considerably in acidic media. Moreover the electrode reaction of NHPI in the presence of ethylbenzene had very good agreement with the voltammetric characteristics of the electrocatalytic mechanism (EC'). The effect of solution condition has been studied and the results confirmed that fortunately the best electrocatalytic performances were also obtained at acidic media. Moreover, the qualitative conversions of ethylbenzene and diphenylmethane have been performed. But considering the economical and environmental concerns a NHPI functionalized oriented mesoporous silica films has been designed and the preparative conversions were achieved using the supported form of NHPI.[2] The results showed that the system is capable of green oxidation of alkylbenzenes in good yields with high selectivity, without any byproduct.

**Keywords:** NHPI; alkylbenzene; electrooxidation; mesoporous silica

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# Magnetic Field Effect on The Pulse Electrosynthesis of Iron Nanoparticles

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## Abstract

A facile electrochemical method to synthesize the iron nanoparticles in the presence of magnetic field was introduced. For a first time, magnetic field is applied during electrosynthesis process. The electrochemical cell consists of two stainless steel (316L) electrodes in Iron sulfate 5 mM solution as precursor and Silver nitrate 25 µM as a nucleation agent. The used experimental conditions included temperature of 95 °C, pulsed current of 20 mA/cm$^2$, pulse time of 18 ms and relaxation time of 54 ms. In the mentioned conditions, Iron nanoparticels with narrow range of particles sizes (30-50 nm) is produced in the cathode. In the presence of a magnetic field ranging from 0.4-1.6 T (Tesla), superimposed parallel to the surface of cathode, depending on the strength of magnetic field and the position and distance from cathode, effective changes have seen in the morphology, particle size and magnetic properties of Iron nanoparticles which were studied by XRD, SEM and VSM. The experimental results showed that the particles sizes and the morphology of the synthesized iron strongly depend on the power of magnetic field. In magnetic field power of 0.4 T and 1.6 T which the magnets were nearest to cathode, the synthesized particles are in special tubular forms with diameter range of 100-250 nm. In 0.8 T, the nanoparticles are cubic with size of 45-75 nm. In 1.2 T the particles are the same as the absence of magnetic field. Therefore, the arrangement of magnets is more important than the magnetic power. Based on the obtained results, by using magnetic field during electrosynthesis process, the morphology, particles sizes and the properties of the electrochemically synthesized iron nanoparticles can be easily changed.

Keywords: magnetic field, Iron nanoparticles, pulsed current, electrosynthesis, magnetization

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# Determination of Chlorpromazine on the Surface Glassy Carbon Electrode Modified by Nickel Oxide Nanoparticles

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## Abstract

In the present work, nickel oxide nanoparticles electrochemically synthesis on the surface of glassy carbon electrode. Cyclic voltammetry, electrochemical Impedance spectroscopy and scanning electron microscopy were used for characterization of modified electrode. The electrochemical behavior of chlorpromazine (Cpz) on the surface of glassy carbon electrode modified with nickel oxide nanoparticles investigated. The modified electrode has shown a good catalytic effect for oxidation of Cpz in alkaline solutions. Result shown that the modified electrode can used for sensitive determination of Cpz.

**Keywords:** Cyclic Voltammetry; Nickel Oxide Nanoparticles; Chlorpromazine

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# Raman spectroscopy of polyaniline/graphen nanocomposite modified electrode and its electrocatalytic activity on hydroquinone

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## Abstract

The modified electrode of polyaniline/graphene (PANI/Gr) composites was prepared by electrochemical synthesis of aniline monomer and graphene oxide in phosphoric acid. The PANI/Gr composites modified electrodes were utilized for fabricating the hydroquinone chemical sensor. Morphological, structural and the optical properties The PANI/Gr composites modified electrodes were extensively characterized by SEM, FTIR and UV spectroscopy. The Raman studies revealed that PANI/Gr composite modified electrode possessed both Gr and PANI Raman bands, suggested the π–π* electron interaction between $C–N^{+\bullet}$ of PANI and carboxylate group of Gr. The sensing performance of the fabricated chemical sensor toward the detection of hydroquinone was measured by a two electrode current–voltage (*I–V*) technique. A very high sensitivity of $10^{-3}$ $mM^{-1}$ and reasonable detection limit of $10^{-6}$ mM with correlation coefficient (*R*) of 0.9987 and short response time (10 s) were observed by PANI/Gr composites modified thin film electrode.

**Keywords**: Hydroquinone; Electrocatalytic oxidation; Raman spectroscopy;

Polyaniline; Modified electrode**.**

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# Electrochemical synthesis of new acetaminophenderivatives

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## Abstract

Electrochemical oxidation of acetaminophen has been studied in the presence of indolederivatives as nucleophiles in water/acetonitrile mixture by means of cyclic voltammetry and controlled-potential coulometry. The reaction mechanism is believed to be *EC* including oxidation of acetaminophen and Michael addition reaction. In this work, we report the synthesis of mono substituted of acetaminophen in good yields based on controlled potential condition at carbon electrode in an undivided cell.The products of electrolysis have been purified and characterized by FT-IR, $^{1}$H NMR, and MS.

### Keywords

Acetaminophen, indolederivatives, Electrosynthesis, Controlled-potential coulometry, Cyclic voltammetry.

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# Electrochemical oxidation of 4-*tert*-butylcatechol in the presence of aniline derivatives

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## Abstract

A facile and one-pot electrochemical method for the synthesis of aminoquinonederivatives generated from the electrochemical oxidation of 4-*tert*-butylcatechol (**1**) in the presence aniline (**2a**), 2,4-dimethyl aniline (**2b**), 2,4-dimetoxi aniline (**2c**), 4-chloro aniline (**2d**) and 2-methyl aniline (**2e**) as nucleophiles was reported. The results revealed that the electrochemically generated electrophile derived from oxidation of **1** participate in Michael-addition reactionswith **2a-e**. In this work, we report the synthesis of mono substituted of 4-*tert*-butylcatechol (**1**) *via* an *ECE* (*E*, electrochemical; *C*, chemical) pathwayin good yields based on controlled potential condition at carbon electrode in a divided cell. The products of electrosynthesis have been purified and characterized by FT-IR, $^{1}$H NMR, $^{13}$C NMR and MS.

### Keywords

Aniline, 4-*tert*-butylcatechol, Cyclic voltammetry, Electrosynthesis.

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# The electrosynthesis of propylene oxide

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**Abstract**

Propylene oxide is a significant organic chemical product used primarily as a reaction intermediate for production of polyether polyols, propylene glycol, alkanoamines, glycol ethers and many other useful products.

Applying an electrical current to a brine solution containing propylene results in oxidation of propylene to propylene oxide. In this study sodium bromide has been used as the electrolyte. The electrochemical behavior of it has been investigated by cyclic voltammetery and Electrochemical Impedance Spectroscopy in the absent and present of peropylene. Bromine, generated from bromide ions at the anode, reacts with propylene and water to form propylene bromohydrine . Hydroxide generated at the cathode then reacts with the bromohydrine to yield propylene oxide. The net reaction involves transfer of two electrons:

The effects of some parameters such as applied potential and gas flow on the current efficiency and chemical conversion has been study.

**Keywords:** electrosynthesis, propylene oxide, sodium bromide, cyclic voltametery, electrochemical impedance spectroscopy

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4 , 5 December 2013

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# The electrocatalytic behavior of Pd supported on nanoporous stainless steel in glycerol electrooxidation

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## Abstract

Nanoporous stainless steel (NPSS) prepared using anodization process, duo to its novel characteristics such as low cost, commercial availability, high corrosion resistance, mechanical strength and electric conductivity [1], was used as an electrode material to support noble metal-based catalysts. Copper (Cu) as a less-noble and inexpensive metal was electrodeposited into the pores of NPSS and then replaced with palladium (Pd). Scanning electron microscopy (SEM), cyclic voltammetry and chronoamperometry methods were used to investigate the surface morphology and electrochemical behavior of NPSS/Cu/Pd electrode. The SEM images showed a porous thin film composed of ordered Pd nanoparticles covers all the surfaces, resulting in a high active surface area. Considering the electrocatalytic activity of NPSS/Cu/Pd toward glycerol electrooxidation reaction in alkaline media showed that it exhibits remarkable catalytic properties and a good long-term stability. This work indicates that the NPSS/Cu/Pd electrode has a potential application in electrochemical devices such as sensors and fuel cells.

**Keywords:** Nanoporous stainless steel; Galvanic replacement; Palladium; Glycerol oxidation.

**References:**

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# Electrodeposition of Gold Nanosturctures on FDTO

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## Abstract

Electrodeposition of gold arrays of nanometre dimensions (<40 nm) on fluorine-doped tin oxide (FDTO) coated glass is reported. It is relevant to the electrodeposition of gold nanoparticulate entities in different morphologies on a conducting substrate, Fluorine-doped tin-oxide, and the manipulation of the electrodeposition conditions in order to influence and control the size and surface concentration of various shapes. This is not the shape control process. We aimed at the controlled growth of gold nanoarchitechtures from an aqueous solution by potentiostatic single pulse and double pulse electrodeposition. Very high size homogeneity and different geometries has been created by using FDTO thin plates as a working electrode (WE) and the mixture of Hydrogentetrachloroaurate(III) trihydrate in concentrated drops of fuming HCl and we could setup an electrochemical substrate for electrodeposition of gold nanostructures on FDTO. In order toachieve size monodispersity instantaneous nucleation is essential, and 3Dgrowth is preferable to produce high surface area deposits.In the potentiostatic conditions, the amperometriccurves was observed for instantaneous and progressive electrodeposition, respectively. The nucleation and growth pulses cause the formation of gold nanostructures with different geometries onto the FDTO. The presence of nanostructures has been checked with the bare FDTO and comparing to the final FDTO through SEM images. Analysis of SEMs confirms the formation of gold nanoarrays on FDTO. The average size of nanoparticles on the surface is less than 20 nm for spheroids.

**Keywords:** Single pulse and Double Pulse Electrodeposition, FDTO, Gold Nanoparticles

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Optimization of conditions pulsed electropolymerization aniline- pyrrole copolymer nanoparticles

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## Abstract

In recent years, great scientific attention has been paid to electroconductive polymers such as polythiophen, polypyrrole, polyacetylene, polyaniline [1]. Conductive polymers are being used commonly for various purposes including rechargeable batteries, chemical transistors, production of semiconductor photoanodes, electrochemical displays, restoration of data, indicators of gasometers, biochemical analysis, sensors and biosensors [2]. In this work, aniline-pyrrole copolymer nanoparticles were synthesized by exerting a pulsed electrical current between two coaxial mesh platinum electrodes in the acidic aniline and pyrrole solution. In pulse electropolymerization, there are some parameters which can affect on the structure and the particles sizes of aniline- pyrrole copolymer. These parameters include current density, pulse time ($t_{on}$), relaxation time ($t_{off}$), temperature and the concentrations of aniline, pyrrole and hydrochloric acid. In this work, the amount of some parameters were investigated and optimized by the "one factor at a time" method to obtain a most uniform and smallest nanoparticles. The synthesized samples were studied by SEM. Four samples were selected to more characterize by UV-Vis spectroscopy, cyclic voltammetry and measurement of electrical conductivity. Based on the obtained results, the optimized conditions includes 9 mA $cm^{-2}$ pulse height, 1 s $t_{on}$, 1 s $t_{off}$, 1 $^{o}$ C solution temperature, 0.1 M aniline, 0.1 M pyrrole and 0.12 M HCl. SEM images of the samples showed that the optimized sample includes uniform nanoparticles of aniline- pyrrole copolymer with 23 nm average diameters.

**Keywords:** Pulsed electropolymerization, aniline-pyrrole copolymer, nanoparticles

**Refrences:**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# DFT study of Hydrogen molecule Storage by Lithium cation within Boron Nitride fullerenes like in the gas phase

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**Abstract**

Hydrogen has thus been conceived as a clean fuel source as against the oil and natural gas resources and unlike the latter, seldom pollutes the environment. BN fullerene materials would store $H_2$ molecule easier than carbon fullerene materials, and its stability for high temperature would be good. The purpose of the present work is to investigate hydrogen gas storage and adsorption it on the BN nanocluster i.e. $B_{16}N_{16}$ and $B_{24}N_{24}$, $Li^+@B_{16}N_{16}$ and $Li^+@B_{24}N_{24}$ by DFT/ M062X/6-311G (D, P) with Gaussian 09 software. We have calculated the HOMO-LUMO and Band gap and adsorption energies, Dipole moments and charge transfers. In the next stage we compare two these groups from the point view of adsorption energy. According to this work, it can be seen by placing $Li^+$ within $B_{16}N_{16}$ and $B_{24}N_{24}$ nanofullerenes like structures, the adsorption energy is much than to the case where the $Li^+$ cation is not. We have find the highest absorbed energy for $H_2/Li^+@B_{24}N_{24}$ among them and the highest dipole moment is belong to $Li^+@B_{16}N_{16}$-$H_2$ .

**Keywords: Boron Nitride nanofulleren; Density functional theory; adsorption; Lithium cation; $H_2$.**

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University of Tarbiat Modares, Tehran, Iran

# First principles study of the structural and electronic properties of $Zn_{1-x}Y_x$(Y = Cd,Mg)O nanotube

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## Abstract

Structural, electronic and optical properties of Cd and Mg doped single walled ZnO nanotubes are investigated by using density functional theory. Our calculated formation energy shows that Mg doped ZnO nanotubes are stable than pristine and Cd doped ZnO nanotubes. It is found that semiconducting energy gap of Cd doped single walled ZnO nanotubes is smaller than their undoped ZnO nanotubes while it is bigger for Mg doped single walled ZnO nanotubes.

## Keywords

**ZnO nanotubes, Density functional theory(DFT), Generalized gradient approximation(GGA)**

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9th Iranian Annual Seminar of Electrochemistry

4,5 December 2013

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# Voltammetric determination of tryptophan using modified ionic liquid Pt/CNTs nanocomposite paste electrode in food samples

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## Abstract

Tryptophan, an essential amino acid for humans and is a vital component to building and maintaining a positive nitrogen balance in man. So, detection of sensitive, simple and inexpensive of tryptophan, is a great benefit. In this research, an electrochemical sensor for the determination of tryptophan based on a novel Ionic liquid/Pt/CNTs paste electrode (ILs/Pt/CPE) has been developed. The modified electrode showed excellent electrocatalytic activity toward the oxidation of tryptophan. Under the optimum conditions, the voltammetric oxidation peak current of tryptophan showed two linear dynamic ranges with a detection limit of 0.05 µM for tryptophan using square wave voltammetric method. The method is of good recovery, reproducibility and high sensitivity, and provides a practicable solution for determining of tryptophan in Wheat, barley, corn samples.

**Keywords:** Food analysis; Modified carbon paste electrode; Wheat, Barley, Tryptophan.

9th Iranian Annual Seminar of Electrochemistry

4,5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Effect of carbon nanotubes (CNTs) and culture medium type (MS and B5) on *in vitro* germination of strawberry seeds

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## Abstract

This experiment was conducted to investigation the effect of Carbon Nanotubes (CNTs) and culture medium type (MS and B5) on germination indexes of strawberry seeds. The seeds cultivated on MS and B5 culture medium were preparation in 5 concentrations of Carbon Nanotubes (0, 5, 10, 20 and 40 µg/ml). In the end of experiment period (40 day) germination indexes containing germination percentage, germination rate, time of 50% final germination, means of radicle and plumule length (two week after germination) was used for germination evaluation. The result showed that cultured seeds on MS and B5 medium containing 10, 20 and 40 µg/ml concentrations after 40 days no sign of germination. In 0 (control) and 5 µg/ml concentrations of CNTs, the seeds germinated that in most of indexes, control treatment was better and difference of means was significant. The result showed that CNTs around of strawberry seeds in high concentrations could remove germination that because induce of toxicity in this concentrations.

**Keywords: carbon nanotubes, culture medium, strawberry seed**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Reductive Dechlorination of Carbon Tetrachloride by Copper Nanoparticles @ Graphene Oxide Composites

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## Abstract

Chemical reduction of many substances in the environment can be coupled with oxidation of zerovalent metals ($M^0$).In the reductive dechlorination reaction by $M^0$, the anodic $M^0$ is oxidized into $M^{n+}$ ions, and chlorinated hydrocarbons, as electron acceptors are converted to hydrocarbons and chlorides under anaerobic conditions. Metal nanomaterials have unique properties but, due to the extremely high reactivity, the initially formed nanoparticles become either quickly oxidized by surrounding media or agglomerated during the reaction course. Consequently, graphene is used for supporting nanoparticles. Graphene nanocrystal composites with enhanced properties could be obtained by decoration of graphene materials with metal nanoparticles. In this work, the performance of the copper nanoparticle/graphene oxide composite (CGC) for the dechlorination and removal of carbon tetrachloride (CT) was evaluated. Some parameters such as contact time, sorbent dosage were optimized and under optimal conditions 99.2% of CT was removed. Adsorption of the CT on CGC is better described by Longmuir model.

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**Keywords**: Graphene oxide; Copper nanoparticle; Carbon tetrachloride; Dechlorination

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthesis of magnetic Iron oxide-Reduced graphene oxide (RGO) nano-composite for aptamer immobilization

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## Abstract:

Magnetic nano-composite of Iron oxide-Reduced graphene oxide (RGO) were synthesized by co-pricipitation of iron salts in the presence of graphene oxide (GO) and finally the GO was reduced with hydrazine monohydrate in 90ºC. This nano-composite was used as a suitable surface for stanch aptamer immobilization. The physical and chemical properties, morphology, structure and microstructure of the nano-composite were examined with Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy (SEM), X-ray diffraction (XRD), Electrochemical impedance spectroscopy and Cyclic voltammetry. The inquiries were indicated that, the attendance of Chitosan on the surface of nano-composite can increase the biocompatibility and obtain a much better situation for covalently attach of 5'-amino-terminated aptamer onto the nano-composite via a linker of glutaraldehyde (GA). Finally, effective parameters such as concentrations and reaction times in all stages of the work were optimized in order to increase the loading amount of aptamer DNA sequence.

**Keywords:** Magnetic Nanoparticles, Graphene, Aptamer

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4 , 5 December 2013

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# Covalent functionalization of carbon nanoparticles for extraction and electrochemical determination of dopamine

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## Abstract

Recently, various types of carbon nano-materials such as nanotube, graphenes, nanoparticles and nanofibers have attracted considerable interests and have become a wide area of research owing to their unique physical and chemical properties which can provide an important and feasible platform for electroanalysis particularly in the design of modified electrodes for electrochemical sensing. In contrast to Nanotubes and fullerenes, carbon nanoparticles (CNPs) are well Known for many years (e.g., as carbon black) and they have been widely used in industry for example as filler and pigments. Nevertheless, these carbon nanoparticles similar to metal nanoparticles are very interesting building blocks in thin film electrode systems and their high level of interfacial edge sites are potentially beneficial in electrochemical processes.

Dopamine is a simple organic chemical in the catecholamine and phenethylamine families that plays a number of important roles in the brains and bodies of animals. Several important diseases of the nervous system are associated with dysfunctions of the dopamine system. Therefore, determination of dopamine in biological samples is very important.

In this report, covalent functionalization of carbon nanopaticles surface has been performed. The thiol end group has been formed at the surface of CNPs. The functionalized CNPs were characterized by using scanning electron microscopy (SEM), cyclic voltammetry (CV) and FTIR spectroscopy. The Functionalized CNPs were casted at the surface of glassy carbon electrode. The fabricated electrode has been applied for extraction and quantitative determination of dopamine. The extraction parameters such as time, agitation rate and pH have been optimized. In optimum condition, the dynamic linear range between$1.0\times10^{-8}$ to $1.0\times10^{-5}$ M was obtained. The determination of dopamine in human serum has been demonstrated.

**Keywords:** Thiol ended carbon nanoparticles; Extraction; dopamine; voltammetric sensor;

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Application of nanomaterials for fabrication of ERBB2 sensitive aptasensor

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## Abstract:

Due to the increasing rate of breast cancer patients in our country and lack of some sensitive devices in order to detection of this type of cancer in an early stage of the treatment with low concentration, it is so important to investigate and study on the detection of breast cancer cells. In this work a sensitive aptamer-based biosensor for the detection of ERBB2 receptor was developed by using the electrochemical transduction method. A special immobilization interface consisting of Multiwalled carbon nanotubes/Chitosan (MWCNTs/Chit) nanocomposite was utilized to improve the conductivity and performance characteristics of the biosensor as well as to increase the loading amount of aptamer sequence. Aaptamers were covalently attached onto MWCNTs/Chit modified glassy carbon (GC) electrode via a linker of glutaraldehyde (GA). Methylene blue (MB) was used as an electrochemical indicator which will intercalated into the aptamer through the specific interaction with its guanine bases.

**Keywords:** Aptasensor, Erbb2 receptor, Aptamer, Carbon nano tubes

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# Dispersion of graphene in aqueous solutions with Triton X-100 surfactant

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## Abstract

Due to its unique physicochemical properties, graphene has generated intense interest in recent years. Although much interesting work has been carried out on icromechanically cleaved graphene, it is be necessary to develop high-yield, highthroughput processing methods for many applications. our group and others have developed techniques to disperse and exfoliate pristine graphene using surfactants without oxidation or defect formation. We have dispersed graphene in water, stabilized by a range of different concentration Tritonx-100 surfactants. The process uses low power sonication for long times (up to 30 h) followed by centrifugation to yield stable dispersions. The results of UV–vis analysis suggested that optimum dispersion was achieved with 1.3 mM TX-100 surfactant. Raman spectroscopy shows the flake bodies to be relatively defect-free for centrifugation rates at 3000 rpm.

**keywords: Graphene, Triton X-100, Raman spectroscopy, Sonication**

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# Simultaneous Determination of AA, LD, UA, Insulin and ASA Using Trifunctional Electrochemical Sensor

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## Abstract

In this work, a trifunctional electrochemical sensor for simultaneous determination of ascorbic acid (AA), Levodopa (LD) and Insulin was fabricated by modifying the glassy carbon electrode (GCE) with multi–walled carbon nanotubes and reactive blue (RB–MWCNT–GCE). The RB–MWCNT–GCE shows four pairs of redox couple in a phosphate buffer solution (pH 7.0). The electro–catalytic activity of the modified electrode for the oxidation of AA, LD and Insulin was studied. The detection limits of AA, LD and insulin were estimated 0.45 µM, 0.37 µM and 0.25 µM, respectively, by differential pulse voltammetry (DPV). The RB–MWCNT–GCE could separate the oxidation peak potentials of AA, LD, UA, insulin and ASA in a mixture solution. Finally, using the developed sensor, AA, LD, UA, insulin and ASA were determined in real samples with satisfactory results.

**Keywords:** Insulin; Ascorbic acid; L-dopa; Uric acid; Simultaneous determination

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# Electrochemical Behavior and Electrocatalytic Activity of Imidazole/MWCNT modified GCE as a Hydrazine Sensor

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## Abstract

In present study, electrochemical characteristics of an electrodeposited imidazole film on multi–wall carbon nanotubes glassy carbon electrode (IMWCNT–GCE) and its role as a sensor for electrocatalytic oxidation of hydrazine are described The charge transfer coefficient, α, and the charge transfer rate constant, $k_s$, of imidazole adsorbed on MWCNT were calculated. The IMWCNT–GCE shows a dramatic increase in the peak current and a decrease in the overvoltage of hydrazine electrooxidation in comparison with that seen at an IMGCE, MWCNT-GCE and AGCE. The kinetic parameters of electron transfer coefficient, α, and the heterogeneous electron transfer rate constant, k′, for oxidation of hydrazine at the modified electrode surface were determined. Differential pulse voltammetry exhibits three linear dynamic ranges and a low detection limit of 0.15 μM for hydrazine. Finally, the activity of IMWCNT–GCE was also investigated for hydrazine determination in two natural samples.

**Keywords:** Hydrazine; Electrochemical Behavior; Sensor; Imidazole

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# Toxic CO detection by Potassium cationic within Boron Nitride fullerenes like via DFT study in the gaseous phase

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**Abstract**

We have studied the adsorption of carbon monoxide (CO) on Potassium Boron Nitride fullerens like nanoclusters ($B_{16}N_{16}$, $B_{24}N_{24}$, $K^+@B_{16}N_{16}$ and $K^+@B_{24}N_{24}$) by using of density functional theory (DFT) through M062X functional and 6-311G** basis set. The adsorption energies of CO were estimated to ranging from -0.111 to -0.091eV and -0.487 to -0.663 eV for $B_{16}N_{16}$, $B_{24}N_{24}$ and $K^+@B_{16}N_{16}$, $K^+@B_{24}N_{24}$ respectively. The most stable adsorption configurations are those in which the C atom of carbon monoxide are close to the B atom of the surface of Boron Nitride endofullrenes like. It was found that the Boron Nitride endofullrenes like act selectively against the CO gaseous molecule. From four structures, electrical conductivity of $K^+@B_{16}N_{16}$ and $K^+@B_{24}N_{24}$ are sensitive to CO gaseous molecule. Thus, it was deduced that the $K^+@B_{16}N_{16}$ and $K^+@B_{24}N_{24}$ cluster might selectively detect the CO molecule in the presence of $B_{16}N_{16}$ and $B_{24}N_{24}$ nanocages and their adsorption energy are located in the range of physical absorption, it can be considered the $K^+@B_{16}N_{16}$ and $K^+@B_{24}N_{24}$ as candidate sensors for CO molecule and this topic is related to $K^+$ within nanaocage that the properties of nanocage as a sensor have been improved.

**Keywords: Carbon monoxide, Potassium BN endofullrenes like nanocluster Density functional theory, Adsorption**

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## Abstract

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**Keywords: Carbon monoxide, Potassium BN endofullrenes like nanocluster Density functional theory, Adsorption**

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9th Iranian Annual Seminar of Electrochemistry

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# Toxic CO detection by Lithium cation Boron Nitride endofullrenes like nanocluster in the gaseous phase

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**Abstract**

**We have studied the adsorption of carbon monoxide (CO) on Lithium Boron Nitride fullerens like nanoclusters ($B_{16}N_{16}$, $B_{24}N_{24}$, $Li^+@B_{16}N_{16}$ and $Li^+@B_{24}N_{24}$) by using of density functional theory (DFT) through M062X functional and 6-311G** basis set. The adsorption energies of CO were estimated to ranging from -0.111 to -0.091eV and -0.487 to -0.663 eV for $B_{16}N_{16}$, $B_{24}N_{24}$ and $Li^+@B_{16}N_{16}$, $Li^+@B_{24}N_{24}$ respectively. The most stable adsorption configurations are those in which the C atom of carbon monoxide are close to the B atom of the surface of Boron Nitride endofullrenes like. It was found that the Boron Nitride endofullrenes like act selectively against the CO gaseous molecule. From four structures electrical conductivity of $Li^+@B_{16}N_{16}$ and $Li^+@B_{24}N_{24}$ are sensitive to CO gaseous molecule. Thus, it was deduced that the $Li^+@B_{16}N_{16}$ and $Li^+@B_{24}N_{24}$ cluster might selectively detect the CO molecule in the presence of $B_{16}N_{16}$ and $B_{24}N_{24}$ nanocages and their adsorption energy are located in the range of physical absorption, it can be considered the $Li^+@B_{16}N_{16}$ and $Li^+@B_{24}N_{24}$ as candidate sensors for CO molecule and this topic is related to $Li^+$ within nanaocage that the properties of nanocage as a sensor have been improved.**

**Keywords: Carbon monoxide, Lithium BN endofullrenes like nanocluster Density functional theory, Adsorption**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Graphene- graphene oxide- graphite/conducting polymer nanocomposites as supercapacitor electrods

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## Abstract

In this work, graphene were produced using a modified Hummers method and in the next steps the different morphologies of polyaniline, were synthesized by the oxidative polymerization of aniline with ammonium peroxydisulfate in an acidic medium. At the end, chemically modified graphene and polyaniline (PANI) nanocomposites were prepared by in situ polymerization of aniline monomer in the presence of graphene oxide under acidic conditions. The obtained graphene oxide /PANI composites with different mass ratios were reduced to graphene using hydrazine followed by reoxidation and reprotonation of the reduced PANI to give the graphene/PANI nanocomposites. The doping and the ratio of graphene oxide have a pronounced effect on the electrochemical capacitance performance of the nanocomposites. The research data revealed that high specific capacitance and good cycling stability can be achieved either by doping chemically modified graphenes with PANI or by doping the bulky PANIs with graphene/graphene oxide.

**Keywords:** Graphene; graphene oxide; supercapacitor

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# Green synthesis of reduced graphene oxide decorated with gold nanoparticles by rose water as reducing agent and its glucose sensing application

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## Abstract

Here, we report on one-step and eco-friendly method for fabrication of reduced graphene oxidedecorated with gold nanoparticles (rGO-$Au_{nano}$) nanocomposites by using rose water as reducing agent. The prepared materials were characterized using UV-visible absorption spectroscopy, Raman spectroscopy, atomic force microscopy (AFM), scanning electron microscopy (SEM), and X-ray diffraction (XRD). Furthermore, the direct electrochemistry of glucose oxidase (GOD) was accomplished at a glassy carbon electrode modified with rGO-$Au_{nano}$. The resulting biosensor exhibited good response to glucose with linear range from 50 to 400µM with a low detection limit of 10µM.

**Keywords:** Green chemistry; Rose water; Reduced graphene oxide decorated with gold nanoparticle; Biosensor

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4 , 5 December 2013

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# Fabrication and Characterization of ZnO/Graphene/CdS Ternary Nanocomposite for Photoelectrochemical application

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## Abstract

In this research, we have highlighted the role of Graphene in synthesizing a ternary nanocomposite photoanode for photoelectrochemical(PEC) application[1]. First, zinc oxide(ZnO) thin film was deposited on Ti sheet, using Electropulsation with ten consecutive 5V pulse, followed by 5 minutes Electrodeposition. Graphene was prepared by using Hummers method followed by one step thermal reduction. The ZnO/Graphene hybrid was produced by Electrophoretic deposition(EPD) and finally; it was decorated with Cadmium Sulfide(CdS) quantum dots, using 20 cycles SILAR method. Structural, chemical and optical properties of the nanocomposites were studied by Scanning Electron Microscopy(SEM), X-ray Photoelectron Spectroscopy(XPS) and Diffuse Reflectance Spectroscopy(DRS). Since the Fermi energy level of Graphene is located below conduction band of ZnO and that of CdS, the recombination rate of photogenerated electron-hole pairs in the water splitting reaction is suppressed remarkably[2], and as a result, the amount of photocurrent density as well as the efficiency of PEC cell was enhanced.

**Keywords:** Photoelectrochemical, Ternary Nanocomposite, Graphene

[1] Aneng Cao, Zhen Liu, Saisai Chu, Minghongh Wu, Ye Zhengwei cai, Advanced Material 22 (2010) 103
[2] Peng Gao, Jincheng Liu, Darren Delai Sun, Wunjen Ng, J of Hazardous Material 250 (2013) 412

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A New Approach to Synthesis of Electrochemically Reduced Graphene Oxide; Galva pulse Method

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## Abstract

We report a facile, fast and friendly environment approach regarding electrochemical reduction of graphene oxide by galvanostatic method. Cathodic current densities of 0.3 to 20 mA/cm2 was applied between working and counter electrode in the phosphate buffer solution (PBS) pH 9.25 including dispersed graphene oxide nanosheets and subsequently resistance alteration of the Electrochemically Reduced Graphene Oxide (ERGO) film was carefully monitored by Electrochemical Impedance Spectroscopy (EIS) technique. Additionally, The obtain graphene film was characterized by scanning electron microscopy, X-ray diffraction, Raman spectroscopy, Fourier transform infrared spectroscopy and electrical resistivity experiments. It is found that an optimum cathodic current density of 20 mA/cm$^2$ for 100s can be efficiently removing the oxidation functional groups toward graphene oxide and as well as the electrical resistivity of the proper introduced thin film was measured about 43.4 ohm/square.

**Keywords: Graphene, Galva pulse, Thin film**

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4,5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A high sensitive electrochemical sensor based on Pt/CNTs nanocomposite modified carbon paste electrode for simultaneous determination of N-actylcysteine, NADH and folic acid

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## Abstract

In this study, we report the synthesis and application of a Pt/CNTs nanocomposite as a highly sensitive sensor and novel mediator for the determination of N-actylcysteine (N-AC), nicotinamide adenine dinucleotide (NADH) and folic acid (FA). The synthesized materials were characterized with different methods such as TEM, XRD, FESEM, cyclic voltammetry, electrochemical impedance spectroscopy and square wave voltammetry (SWV). The modified electrode exhibited a potent and persistent electron mediating behavior followed by well-separated oxidation peaks of GSH, NADH and FA. The peak currents were linearly dependent on N-AC, NADH and FA concentrations with detection limits of 0.009, 0.2 and 0.9 µmol $L^{-1}$, respectively. The modified electrode was used for the determination of these compounds in real samples such as tablet, pharmaceutical serum and urine.

**Keywords:** Pt/CNTs nanocomposite; N-actylcysteine; NADH, Folic acid.

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University of Tarbiat Modares, Tehran, Iran

# Voltammetric determination of sudan I in Ketchup and Chilli powder using modified ionic liquid nanocomposite paste electrode

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## Abstract

Ionic liquid/Pt/multiwall carbon nanotubes nanocomposite paste electrode (ILs/Pt/MWCNTPE) has been used as a novel sensor for the efficient quantitative determination of sudan I in food samples by using differential pulse voltammetry (DPV). This new sensor shows a better electrochemical response with lower over-potential and high sensitivity for sudan I compare to unmodified carbon paste electrode (CPE) in aqueous buffer solution. The electro-oxidation of sudan I occurred in a pH dependent, $e^-$ and H+ process and the electrode reaction followed diffusion controlled pathway. Under the optimum conditions, the voltammetric oxidation peak current of sudan I showed two linear dynamic ranges with a detection limit of 0.01 µM for sudan I. The novel sensor has been found selective and successfully implemented for the determination of sudan I in real samples such as Ketchup and Chilli powder.

**Keywords:** Food analysis; Nanocomposite; Modified carbon paste electrode; Ketchup and Chilli powder

analysis

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Glucose Biosensor by Usage Graphene Oxide-Multiwalled Carbon Nanotube Hybrids by Microwave Irradiation Modified Glassy Carbon Electrode

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Graphene oxide-multiwall carbon nanotubes (GO-MWCNTs) hybrid is synthesized using microwave irradiation. The product was characterized by Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and Transmission electron microscopy (TEM). Further the obtained graphene oxide-multiwall carbon nanotubes hybrid used as electrode for electrochemical studies in $K_3Fe(CN)_6$ standard redox system and shows, enhancement in electrocatalytic behavior, compare to each one of individual starting material. The graphene oxide-MWCNTs hybrid electrode were synthesized at different conditions and used as carrier for the immobilization of glucose oxidase (GOX). Also the electrode was applied for amperommetric sensing of glucose in optimum buffer solution and specifically, the attached GOX on graphene oxide-MWCNTs hybrid electrode showed quasi-reversible cyclic voltammogram with the formal potential of -442 and -408 mV. In addition, GOX on graphene oxide-MWCNTs electrodes responded to glucose in the linear concentration range from 0.067 to 490.92 mM. The presence of ascorbic acid, uric acid and chloride ions together with the glucose in the solution seen to be not interfering detection result.

Keywords: graphene oxide, multiwall carbon nanotubes, glucose oxidase, Electrochemistry.

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A facile method to coat mullite layer on multi- walled carbon nanotubes (MWCNTs)by anionic surfactant

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**Abstract**

Organic–inorganic hybrid materials, such as nanocomposites and metal oxide frameworks, have drawn considerable interest as potential functional nanomaterials for use in key applications concerning energy and the environment. Hybridising carbon nanotubes (CNTs) with metal oxide nanostructures creates a new class of multifunctional materials with greatly enhanced performances as photocatalysts, chemical sensors, and in fuel cells and batteries. The low resistance of CNT towards oxidation often limits their applicability. The coating of CNT with metal oxides prevents the oxidation.

This paper describe a facile sol–gel method to synthesize mullite-coated multi-walled carbon nanotubes (MWCNTs) using anionic surfactant sodium dodecyl sulfate (SDS) for the first time. This method is quite simple and easy to operate and form a uniform mullite shell. To prepare mullite coating aluminium nitrate nonahydrate [(Al (NO3)3.9H2O] and tetraethyl orthosilicate (TEOS) precursors were used. Sodium dodecyle sulfate (SDS) in aqueous medium under ultrasonic as an anionic surfactant was used for proper dispersion of carbon nano tubes. The prepared sol was added drop by drop to stable nano tubes suspention. Chemical reaction occurred at pH=2 in 50% wt. CNT to mullite. Finally carbon nano tube and mullite precursor suspention converted to gel on a hot plate. Dried gel was subjected to thermal treatment at 1200°C in microwave furnace with argon atmosphere.

The CNTs-Mullite hybrid is characterized by x-ray diffraction (XRD) and field emission scanning electron microscopy (FESEM). X-ray diffraction (XRD) demonstrates the presence of mullite phase. Images of Field Emission Scanning Electron Microscopy (FESEM) confirm formation of a uniform coating on the surface of carbon nanotubes. The thickness of mullite coating on carbon nano tube is estimated 1-3 nm. Investigation of thermal gravimetric analysis (TGA) reveals that the presence of mullite can inhibit oxidation of CNT in air atmosphere and postpone oxidation temperature 110 degrees in respect to pristine CNTs.

**Keywords:** Multi-walled Carbon nanotubes (MWCNT), Mullite, Coating, Sol- Gel, Oxidation resistance

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Application of Nanoparticles and Moleculary Imprinted Polymer as Modifier for Fabrication of Electrochemical Sensor for Determination of Trace Amounts of Morphine

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## Abstract

In this context a simple and rapid method for trace amounts of morphine (MO) detection has been described based on electrochemical methods of pencil graphite electrode (PGE) which was constructed by using Multiwall carbon nanotubes (MWCNT), molecularly imprinted polymer (MIP) and gold-nanoparticles (AuNPs). The structural morphology of the electrochemical sensor was characterized by field emission scanning electron microscopy (FE-SEM) technique. Various types of electrochemical methods containing cyclic voltammetry (CV), square wave voltammetry (SWV) and electrochemical impedance spectroscopy (EIS) were employed to investigate the characteristics of the electrode in 5.0 mM $K_3[Fe(CN)_6]$ as a prob. The calibration curve was obtained under optimized conditions that showed signal increased with concentration in two linear rang of $8.0\times10^{-3}$ to 5 µm with a detection limit of 2.85 nm (S/N=6). Finally, the ability of the electrochemical sensor was successfully applied for determination of MO in real samples such as human urine and plasma.

**Keywords: Morphine, Multiwall carbon nanotubes, Au-nanoparticles, Molecularly imprinted polymer, Pencil graphite electrode.**

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9th Iranian Annual Seminar of Electrochemistry

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# Potentiometric studies of dipicolinic acid -3,4-diaminopyridine - $Ca^{2+}$- $M^{2+}$ ion quaternary system using Hyperquad program

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## Abstracr

The protonation constants of Dipicolinic acid (dipic) and 3,4-diaminopyridine (dap), the equilibrium constants for the dipic-dap proton transfer system and the stoichiometry and stability constants of the binary, ternary and quaternary complexes of this system with $Ni^{2+}$, $Zn^{2+}$ and $Ca^{2+}$ in a aqueous solution were investigated by potentiometric *p*H titration method. The stoichiometry of the most complexes species in solution was found to be very similar to the crystalline cited metal ion complexes.

**Keywords:** Proton transfer, Dipicolinic acid, 3,4-diaminopyridine

The determination of the equilibrium constants for the dipic-dap proton transfer system interaction between dipic and dap were reported previously by our researcher group [1].The cumulative stability constants of $M_mN_nL_lQ_qH_h$, $\beta_{mnlqh}$, are defined as:

$$mM + nN + lL + qQ + hH \xleftrightarrow{\beta_{mnlqh}} M_mN_nL_lQ_qH_h$$

$$\beta_{mnlqh} = [M_mN_nL_lQ_qH_h]/[M]^m[N]^n[L]^l[Q]^q[H]^h$$

Where L, Q, M, N and H are dipic, dap, $Zn^{2+}$or $Ni^{2+}$, $Ca^{2+}$ ions and proton respectively and l, q, m, n and h are the respective stoichiometric coefficients.The stabilityconstants were calculated from the potentiometric pH titration curves using the Hyperquad2008 program. Also the results of the solution investigation by potentiometric method, confirmed whatever obtained from solid state studies.

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9th Iranian Annual Seminar of Electrochemistry

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# Potentiometric investigation of 2,5 pyridine dicarboxylic acid - pipyrazine proton-transfer system and it's complexes with some metal ions

**afsaneh farazmand, ardeshir shokrollahi**

Proton transfer systems between some pyridine dicarboxylic acids and bases pipyrazine were considered [1,2,3] .Although the protonation and complexation of 2,5 pyridine dicarboxylic acid with proton and several metal ions have been investigated in literature[4], but there isn't any report about the its proton transfer with bases in solution In this study the protonation constants of 2,5 pyridine dicarboxylic acid(2,5-pydc), pipyrazine (pipz), the equilibrium constants for the pydc/pipz proton transfer system and stoiciometry and stability of complexation of this system with some metal ions such as $cd^{2+}$, $Ni^{2+}$ and $Zn^{2+}$ in aqueous solutions at 25°C and μ = 0.1M $NaNO_3$ were calculated by best program using pHmetric data[5] and the corresponding distribution diagrams were depicted using Hyss2009 as a new of older version [6]. The stoichiometry of the most species in solution was compared to the corresponding crystalline cited complexes.

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4 , 5 December 2013

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# Electrochemical Impedance Spectroscopic Study of polypyrrole/polyaniline composite electrosynthesized in aqueous medium

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## Abstract

The applications of conducting polymers in electrocatalysis, capacitors, sensors, fuel cells and corrosion protection have been reported[1-3]. Of all the conducting polymers polyaniline (PAni) and its derivatives are the most studied which could be due to their peculiar electrical, optical and magnetic properties.
In this study Electrosynthesis of composite of Poly-aniline and poly-pyrrole 50 mM in phosphoric acid 1M on 2B pencil composite graphite was accomplished using potassium chloride 2M and para-Toluenesulphonic acid 0.06M as supporting electrolytes. Three pairs of redox peaks can be seen in cyclic voltammogram of poly-aniline electrosynthesized that current of this peaks has decreased by increasing molar ratio of para-Toluenesulphonic acid. The impedance technique using for investigation charge-transfer resistance of maked electrodes. The nyquist plot of impedance of poly-aniline shown Increase of the charge transfer resistance in the presence of most molar ratio of para-Toluenesulphonic acid. Values of the charge transfer resistance of the double-layer composite indicates decreased significantly compared to the single-layer of poly-aniline. Values of the charge transfer resistance of the triple-layer composite indicates less decreased compared to the single-layer of poly-aniline and the double-layer composite.

**Keywords:** EIS; Polymer Composites; Charge Transfer Resistance

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4 , 5 December 2013

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# Simultaneous Determination of Epinephrine and Ascorbic Acid Using Carbon Paste Modified Electrode

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## Abstract

In the present work differential pulse voltammetry coupled with multivariate curve resolution-alternating least squares (MCR-ALS) was applied for simultaneous determination of epinephrine and ascorbic acid in 0.20 M Britton-Robinson (B-R) buffer solution at the surface of a modified carbon paste electrode. Characterization of the modified electrode was carried out by electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV). A strategy based on experimental design was followed. Operating conditions were improved with central composite rotatable design (CCRD) and response surface methodology (RSM), involving several chemical and instrumental parameters. Then second order data was built from variable pulse heights of DPV and after correction in potential shift analyzed by MCR-ALS. Analytical parameters such as linearity, repeatability, and stability were also investigated and a detection limit of 0.14 and 0.18 µM for epinephrine and ascorbic acid achieved, respectively. The proposed method was successfully applied in simultaneous determining the two analytes in human plasma.

**Keywords:** Ascorbic acid; Differential pulse voltammetry; Ephinephrine

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4 , 5 December 2013

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# Simultaneous Determination of Sulfamethoxazole and Sulfametizol Using Carbon Paste Modified Electrode

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## Abstract

In the present work differential pulse voltammetry coupled with multivariate curve resolution-alternating least squares (MCR-ALS) was applied for simultaneous determination of sulfamethoxazole and sulfametizolin 0.20 M Britton-Robinson (B-R) buffer solution at the surface of a modified carbon paste electrode. Characterization of the modified electrode was carried out by electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV). A strategy based on experimental design was followed. Operating conditions were improved with central composite rotatable design (CCRD) and response surface methodology (RSM), involving several chemical and instrumental parameters. Then second order data was built from variable pulse heights of DPV and after correction in potential shift analyzed by MCR-ALS. Analytical parameters such as linearity, repeatability, and stability were also investigated. The proposed method was successfully applied in simultaneous determining the two analytes in human plasma.

**Keywords:** sulfamethoxazole; Differential pulse voltammetry; sulfametizolin

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4 , 5 December 2013

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# Silver Chloride Modified Carbon Paste Electrode: Application to Electrocatalytic Oxidation of Ethanol

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## Abstract

Silver chloride was employed as a modifier for preparation of a new carbon paste electrode. For the first time, the catalytic oxidation of ethanol was demonstrated by cyclic voltammetry, chronoamperometry and amperometry methods at the surface of this modified carbon paste electrode. In CV studies, no oxidation response of ethanol can be seen at the unmodified electrode, indicating the nonelectroactivity of ethanol on this substrate. But at the silver chloride modified carbon paste (SC-MCP) electrode, a large anodic peak appears, indicating that the anodic oxidation of ethanol could be catalyzed at SC-MCP electrode. This proves that the silver chloride bears the main role in electro-catalytic oxidation of ethanol. The catalytic oxidation peak current was linearly dependent on the ethanol concentration. The kinetic parameter such as the electron transfer coefficient (α) and exchange current density ($j_0$) for the modified electrode were calculated.

**Keywords:** Modified carbon paste electrode, Ethanol, Silver chloride

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4 , 5 December 2013

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# Kinetic Study of the Electrocatalytic Oxidation of Dopamine on Silver Fluoride Modified Silver Electrode

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## Abstract

Silver fluoride modified silver electrode was prepared as a new electrode and used to electrocatalytic oxidation of dopamine. Fluoride can form a complex with silver metal, and thus be used to modify a silver electrode surface. The electrocatalytic activity of the modified electrode for the oxidation of dopamine, in aqueous basic solution was studied by using cyclic voltammetry. The silver fluoride modified silver (SFMS) electrode has very high catalytic ability for electrooxidation of dopamine. The modified electrode shows a stable and linear response in the concentration range of 100 to 1000 μmol $L^{-1}$ with a correlation coefficient of 0.9931. For silver fluoride modified silver electrode, the transfer coefficient (α), the number of electrons involved in the rate-determining step ($n_\alpha$) and the catalytic rate constant (k) for modified electrode were calculated.

**Keywords:** Modified electrode, Dopamine, Silver fluoride

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4 , 5 December 2013

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# Preparation Ag/NaA nanozeolite and its application to determination of H2O2

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## Abstract

In this research, synthesized NaA nanozeolite from slag silica was used for determination of $H_2O_2$. The silica in amorphous phase with 63.75% purity was extracted from slag, and used effectively as a new source of silica for the synthesis of NaA nanozeolite. The nano sized NaA in pure phase with a range of 58- 95 nm has been synthesized at low temperature, without adding any organic additives [1]. The silver modified NaA used to investigate the electerocatalytic reduction of $H_2O_2$. The capability of Ag/NaACPE electrode was investigated by cyclic voltammetry in a potential range of -0.8 to 0.2V at various $H_2O_2$ concentrations [2]. In the absence of $H_2O_2$, no obvious reduction current of Ag particles was observed from the CV response. With the addition of $H_2O_2$, a reduction current was observed which increase $H_2O_2$ concentration. The intensity and potential were increased by the modified zeolite electrode.

**Keywords:** nanozeolite; slag; modified electrode

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4 , 5 December 2013

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**Polytetrafluorethylene Film-Based Liquid-Three Phase Micro Extraction Coupled with Differential Pulse Voltammetry for The Determination of Atorvastatin Calcium**

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In this paper, we describe a new combination method based on polytetrafluorethylene (PTFE) film-based liquid threephase micro extraction coupled with differential pulse voltammetry (DPV) for the micro extraction and quantification of atorvastatin calcium (ATC) at the ultra-trace level. Different factors affecting the liquid-three phases micro extraction of atorvastatin calcium, including organic solvent, pH of the donor and acceptor phases, concentration of salt, extraction time, stirring rate and electrochemical factors, were investigated, and the optimal extraction conditions were established. The final stable signal was achieved after a 50 min extraction time, which was used for analytical applications. An enrichment factor of 21 was achieved, and the relative standard deviation (RSD) of the method was 4.5% ($n$ = 4). Differential pulse voltammetry exhibited two wide linear dynamic ranges of 20.0 – 1000.0 pmol $L^{-1}$ and 0.001 – 11.0 μmol $L^{-1}$ of ATC. The detection limit was found to be 8.1 pmol $L^{-1}$ ATC. Finally, the proposed method was used as a new combination method for the determination of atorvastatin calcium in real samples, such as human urine and plasma.

**Keywords:** PTFE film–based liquid three-phase micro extraction; Differential pulse voltammetry; Atorvastatin calcium.

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# Dielectric and impdance spectroscopy characterization of nano electro copolymerization of aniline and 2,4dinitrophenol in Phosphoric Acid Medium

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## Abstract

Electrochemical Impedance Spectroscopy (EIS) is a powerful, rapid and accurate non-destructive method for the evaluation of wide range of materials. This paper reports on anodic homo and copolymerization of Aniline (Ani) and 2,4,dinitrophenol (DNP) on composite 2B pencil graphite (CG) in phosphoric acid (H3PO4) medium. The electrochemical syntheses of these polymers in *para*-toluene sulphonic acid (PTSA) with and without potassium chloride (KCl) are investigated. The presence of KCl in the medium has improved the structural. The dielectric and electrochemical impedance spectroscopy (EIS) of homo and copolymer were investigated by complex impedance spectroscopy in the frequency range of 0.01–$10^5$Hz at room temperature. Both dielectric loss factor and permittivity increase with the decrease of frequency exhibiting strong interfacial polarization at low frequency.the dielectric parameters indicated that the presence of KCl increase the dielectric Constance (figure 1A). the electrochemical impedance spectroscopy (EIS) shows that the increase of molar ratio of PTSA as supporting electrolyte in electro synthesis of homo and copolymer has increased the resistance against charge transfer (Figure 1B).

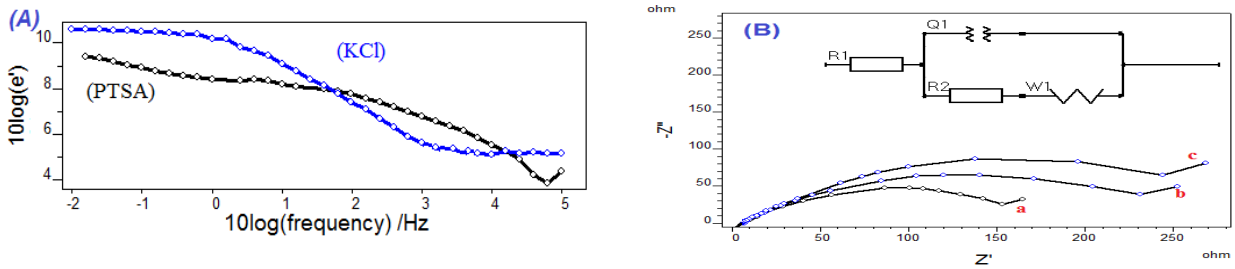


Fig 1 : (A) dielectric spectroscopy of poly (Ani-co-2,4DNP) , (B) Nyquistplots copolymer of aniline and 2,4-dinitrophenol electro synthesized in presence of (a) KCl (b) PTSA and KCL (c) PTSA

**Keywords:**dielectric, impedance spectroscopy**,** polyaniline, conductive polymer, , 2,4dinitrophenole

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Doping of magnetic Fe atoms on semiconductor nano particle CdSe their effects on optical and magnetic properties

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## Abstract

In this article, based on DFT and Wine2k code and GGA approximation, the electrical, structural, and optical properties of Fe-doped CdSe nanoparticle were discussed using preliminary information about CdSe. Fe doping largely changed the electrical, structural, and optical properties of CdSe nanoparticle. CdSe in ground state was diamagnetic; however, in Fe-doping method, the ferromagnetic nature (entity) of this compound was increased. Results indicate that Fe inserted in the center of CdSe nanoparticle is more stable than the Fe located on the surface of CdSe nanoparticle. Furthermore, adding Fe impurity to CdSe nanoparticle decreased the bond length and increased energy gap. Our calculation showed that optical conductivity and absorption index increased by Fe doped to CdSe nanoparticle.

## Keywords

**CdSe nanoparticle, Density functional theory(DFT), Iron impurity**

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4 , 5 December 2013

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# pH and Salting-out Effects on Cefalexin Partitioning in Aqueous Biphasic Systems (TWEEN 20+$Na_3$Citrate/$MgSO_4$)

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## Abstract

In many bioengineering and biochemical engineering processes, the high cost of downstream processing method for the recovery of the product is a key problem. It is considered to be the most expensive part of process production.
One of the most interesting and economical processes for extraction and purification of biomolecules, is Aqueous Biphasic Systems (ABSs). The fact making these systems unique and biocompatible is that the ABSs contain large amount of water in each formed phases, thus a gentle media can be provided for biomolecules in each phase.
In this study, partition coefficient of Cefalexin in promising aqueous biphasic systems (ABS) containing Tween 20, as a non-ionic surfactant, and two different inorganic salts (tri-sodium citrate and magnesium solfate) were studied and their extractive potential were evaluated.
At first, ternary phase diagrams of ATPS consisting of Tween 20 and three different salts ($MgSO_4$ and $Na_3$Citrate) were presented and the results were successfully fitted to Merchuck equation. Salting-out ability of $Citrate^{3-}$, $SO_4^{2-}$, $Na^+$ and $Mg^{2+}$ ions on partitioning of Cefalexin in three different temperatures (300, 304 and 308K) have been investigated through the Setschenow equation in this study as well. Furthermore the influences of $Na_3$Citrate and $MgSO_4$ on partition coefficients were justified by Hofmeister series. Besides, it has been shown that the partition coefficient of Cefalexin increases by moving away from its pI point which is approximately 4.5 to 5 in aqueous solutions.

**Keywords:** Aqueous Biphasic systems, Partitioning, TWEEN 20, Salt, Cefalexin

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4 , 5 December 2013

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# Potentiometric Determination of Oxalate by Surfactant - Modifide Nano-Sized Clinoptilolite Electrode with High Selectivity

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**Abstract**

Zeolites are crystalline microporous aluminosilicates with very well defined structures that consist of a framework formed by tetrahedral of $SiO_4$ and $AlO_4$. The natural zeolites can exchange cations but not anions. This property has been used to modify the external surface of clinoptilolite by adsorbing tetrabutylammunium bromide (TBAB) as a cationic surfactant to improve its anion exchange capacity.TBAB-modified natural Clinoptilolite was used for constructing a PVC membrane electrode for the determination of oxalate from aqueous solution. In this study the clinoptilolite in nanoscale was prepared by mechanical method. The decrease in the crystal sizes results in high external surface areas reduced diffusion path lengths, and more exposed active sites. The nano zeolite was modified with surfactant (SMZ) and used for the modification of PVC membrane, so the membrane contained: a SMZ as a modifier, dioctyl phthalate (DOP) as a softener and polyvinyl chloride (PVC) as a plasticizer. The electrode containing 6% SMZ exhibited linear response range to oxalate in the range of $10^{-6}$ to$10^{-1}$ M with Nernstian slope -29 mV per decade of oxalate concentration. In this study the effects of various parameters such as temperature, detection limit, response time and pH were studied on the potentiometric behaviour of the electrode.

**Keywords: nanozeolite, ion-selective electrode, oxalate, cationic surfactant**

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4 , 5 December 2013

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# Fabrication and electrochemical investigations of the sensors based on metal nano-particles composite modified carbon electrodes and their applications in simultaneous trace determinations of Epinephrine,Indomethacin and Acetaminophen and some other compounds

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## Abstract

The electrooxidation of epinephrine (EPI), indomethacin (IND) and Acetaminophen (ACT) has been investigated by application of nickel hydroxide nanoparticles/ multiwalled carbon nanotubes composite electrode (MWCNTs-NHNPS/GCE) using cyclic voltammetry (CV), differential pulse voltammetry (DPV) and chronoamperometry (CA) methods. Under the optimum conditions the electrode provides a linear response versus EPI, IND and ACT concentrations in the range of 3–160 µM, 0.5–55 µM and 0.05–145 µM respectively using the DPV method. Effective parameters including the potential scan rate, pH solution and accumulation time were studied. Analytical characterizations of the promising modified electrodes were investigated to determine of the species at the optimum conditions. The possible interferences in the measurement of the compounds due to the presence of other species present in real samples were studied and it was found that the proposed procedures are free from interferences of most common interfering compounds.

### Keywords

Epinephrine, Indomethacin, Acetaminophen, Multi-Walled Carbon Nanotubes, Nickel Hydroxide Nano-particles, Modified glassy carbon.

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University of Tarbiat Modares, Tehran, Iran

# Design and fabrication of a pH Electrode based on modified $Fe_2O_3$ nanoparticles

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## Abstract

Metal oxides electrodes have shown several adventages over the conventional glass electrodes [1,2]. A low cost pH electrode was prepared and characterized. Iron oxide modified with sulfate ions was prepared using the sol-gel method. Then in the next step, nanoparticles were used in fabrication of a pH electrode. The proper ratio of modified metal oxide were mixed with carbon and binder and was placed in structure of carbon paste electrode. The electrode presented Nernstian and fast response in the pH range from 1 to 12 and slope of the potential versus pH curve is 54 $mVpH^{-1}$. The electrode is insensible to the presence of $Na^+$ , $k^+$ and $Mg^{2+}$ in the solution. The amount of materials in the prepared electrodes was very small supporting the efficiency of this method on the simple preparation of functional low-cost pH electrodes and mechanically was very stable.

**Keywords:** electrode; pH; $Fe_2O_3$

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# Electrocatalytical Effects Studies of Modified Electrode by Aniline and 2-4 dinitrophenol in Cr Solution

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## Abstract

Polyaniline is one of the oldest artificial conductive polymers that its high electrical conductivity has attracted lots of attentions [1-2] . 2,4 di nitrophenol is an organic compound that can be found as yellow crystalline powder [3]. Deferential pulse voltammetry is one of the most sensitive methods for determining the small amounts of inorganics and organics materials. in this project we study the electrocatalytical effects of modified electrode by aniline copolymerization and 2-4 dinitrophenole . Observing the electrocatalitical effects of synthesized copolymer in Cr solution concluded to the negetive potential and positive current shifts on voltagram compared with the unmodified electrode voltagram.this proves the existence of modified electrode electrocatalytical effects in Cr solution.

### Keyword

Cr, Anilin, Deferential pulse voltammetry

### Refrence

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# Investigation of voltammetric behavior of metronidazole using carbon paste electrode modified with nano clinoptilolite particles Cu(II)-exchanged

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## Abstract

In this work, the catalytic reduction of metronidazole was investigated at carbon paste electrode modified with Cu(II)-clinoptilolite nano-particles. Copper(II) exchanged in clinoptilolite acts as catalyst to reduction of metronidazole. Experimental parameters such as modifier percent, pH, scan rate and concentration of the supporting electrolyte were optimized for the determination of metronidazole. Samples were characterized with TEM, XRD and BET methods to show the formation of a nanoparticles zeolite. The measurements were carried out by application of the cyclic voltammetry, square wave voltammetry and chronoamperometry methods. The linear response was respectively obtained in the ranges of $2\times10^{-9}$ - $4\times10^{-3}$ mol $L^{-1}$ and $8\times10^{-10}$ - $1\times10^{-3}$ mol $L^{-1}$ for CV and Sqw. The detection limit (DL) of metronidazole was obtained as $3.9\times10^{-10}$ mol $L^{-1}$ and $7.1\times10^{-11}$ for CV and Sqw, respectively. The proposed method was successfully used to determine metronidazole in the drugs.

Keywords: Metronidazole, Nano clinoptilolite, Voltammetry

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# Solvent Effects on Redox Behavior of N,N-Dimethyl Phenylene Diamine

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## Abstract

The redox behavior of N,N-Dimethyl Phenylene Diamine (DPD) in nonaqueous solvents was studied by cyclic voltammetry technique. Two well–separated, one-electron voltammetric waves were clearly observed in each solvent.The separation extent of these two half-potentials and their exact positions are closely related to solvent Donor Number . Additionally ,the reversibility of this redox system in different solvents was examined by changing scan rate(0.05-1V/Sec).It is also shown that the heterogeneous rate constant($K_S$) of DPD oxidation has been strongly affected by dynamic properties of solvent such as longitudinal relaxtion time($\tau_L$)

**Key word:** Solvent effect; Donor Number; Longitudinal Relaxation Time

9th Iranian Annual Seminar of Electrochemistry
4 , 5 December 2013
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# Kinetic Study of the Electrocatalytic Oxidation of Alcohols in the Presence Of N-Hydroxysuccinimide

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## Abstract

Oxidation of alcohols is one of the most important chemical transformations involved in many fundamental areas of chemistry. Numerous studies have been attempted to present the green oxidation routes for alcohol oxidation.[1] In the present study, the electrocatalytic behavior of N-Hydroxysuccinimide towards alcohol oxidation was investigated using voltammetry as a versatile and informative technique. Voltammetric responses show that oxidation of N-Hydroxysuccinimide and electrochemical formation of the activated radical of N-Hydroxysuccinimide followed by a catalytic reaction. Diagnostic criteria of cyclic voltammetry have been employed and the results are in good agreements with the characteristics of EC' mechanism.[2] Moreover, the voltammetric analysis of N-Hydroxysuccinimide itself shows that its oxidation followed by a slow chemical reaction which may be due to the relative instability of the electrogenerated radical. Our Investigations revealed that the solution pH could profoundly influence the catalytic performances of the described organocatalyst, and N-Hydroxysuccinimide acts efficiently in diluted acetic acid solution. Moreover, the effect of electronic nature of alcohols were evaluated for a series of benzylic, allylic and aliphatic alcohols and new kinetic data and the rate constant of all coupled chemicl reactions were obtained using voltammetric analyses and digital simulation of cyclic voltammograms. The results clearly demonestraeted that the reactivity of N-Hydroxysuccinimide toward the oxidation of benzylic and allylic alcohols is greater than that observed for aliphatic alcohols. On the other hand, among the aliphatic alcohols, only the secondary ones show a slight reactivity toward N-Hydroxysuccinimide.

## Keywords

Alcohol Oxidation, Voltammetry, N-Hydroxysuccinimide, Digital Simulation

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Effect of a nano-gallium thin layer upon the electrode surface for detecting biomolecules

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## Abstract

This fact is very well known that The electrochemical pretreatment (ECP) of graphite electrodes is well known to improve electrode activity. On the contrary, ECP also induces an increase in the capacitive current and reduces the potential window of these electrodes owing to an increase in surface roughness and oxygen-containing groups.In this letter, the ECR(electron cyclotron resonance) nano-gallium thin layer electrode was studied with respect to morphological and characteristic changes caused by the ECP (electrochemical pretreatment) and also the usage of pretreated ECR nano-gallium thin layer electrode for measuring some biologically important *analytes, including glutathione (oxidized form, GSSG) and serotonin was investigated.*

**Key words***:* ECP,BDD,ECR, Nano-gallium thin layer

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A survey upon Direct electrocatalysis of hemoglobin in a multilayer {nanobarium=PDDA}n hybrid film

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## Abstract

A new amperometric biosensor for hydrogen peroxide ($H_2O_2$) has been developed that is based on direct electrochemistry and electrocatalysis of hemoglobin (Hb) in a multilayer inorganic–organic hybrid film. o-Phenylenediamine (PDA) was electro-polymerized onto a glassy carbon electrode (GCE), and then negatively charged nanobarium particles and positively charged poly (diallyldimethylammonium chloride) (PDDA) were alternately assembled on the PDA=GCE surface. Finally, Hb was electrostatically adsorbed on the surface of barium nanoparticles. The electrochemical behavior of the resulting biosensor (Hb={nanobarium=PDDA}n=PDA=GCE) was assessed and optimized. The performance and factors influencing the biosensor were studied in detail. Under optimal conditions, the immobilized Hb displayed good electrocatalytic response to the $H_2O_2$ reduction ranging from 1.3 mM to 1.4 mM with a detection limit of 0.8 mM. In addition, the biosensor exhibited rapid response, good reproducibility, and long-term stability.

**Keywords**: Direct electrochemistry; barium nanoparticles; hemoglobin biosensor; multilayer, inorganic–organic hybrid film

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4,5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Voltammetric determination of amlodipine besylate at surface of glassy carbon electrode modified using sulfonate carbon nanoparticles

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**ECSS9AT0501403"**

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## Abstract

Amlodipine besylate (AM) is a dihydropyridine derivative with calcium antagonist activity.It is used mainly as an antihypertensive and antianginal Agent. A sensitive and selective electrochemical sensor was fabricated via the drop-casting of sulfonate carbon nanoparticles (4-18nm) suspension onto a glass carbon electode (GCE). The application of this sensor was investigated for determination of AM. In order to study the electrochemical behavior of AM, cyclic voltammograms was recorded at the surfaces of the modified GCE (MGCE) and the bare GCE. The dependence of the potential scan rate and pH were on peak curren and potential investigated. The results exhibites CNPs via a thin layer model based on the diffusion within a porous layer, enhanced the electroactive surface area and caused a remarkable increase in the peak currents. In addition it can show catalytic effect and accelerate the rate of the electron transfer process. Presented good sensitivity and a considerable decrease in the anodic overpotential, leading to negative shifts in peak potentials. An optimum electrochemical response was obtained for the sensor in the buffered solution of pH 7.0 and using 6µL CNPs suspension. Differential pulse voltametry has been used for qunantitative determination of AM. A dynamic linear range of 1.0 × 10−8 to 1.0 × 10− 3 mol L− 1 was obtained the presented sensor has been applied for determination of AM in commerecial tablet.

**Keywords:** 1) Voltammetry 2) Amlodipine 3) Sulfonate carbon nanoparticle 4) Electrochemical sensor

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# The Investigation of Novel Glucose oxidase Biosensor Based on Graphene-Clay nanocomposite

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## Abstract

A feasible and fast method to fabricate glucose biosensor was developed by immobilization of glucose oxidase (GOx) to nano-sepiolite-graphene nanocomposite/glassy carbon electrode. The direct electrochemistry Glucose oxidase not contain medioter and worked in air saturated condition for similarity of in vivo usage. The nano-sepiolite-graphene nanocomposite shows a high conductive and biocompatible template for enzyme immobilization. The immobilized GOx on nanocomposite shows a couple of well defined reversible peak with the anodic and cathodic peak potentials of −430 and −460 mV (vs. Ag/AgCl), corresponding to the FAD/$FADH_2$ redox couple, and with a formal potential of -445 mV in 0.1 M phosphate buffer solution at pH=7. The linear concentration rang of biosensor is 0.14–3.14 µM, and with detection limit of 0.04 µM. Also, the life time of biosensor is more than 4 month.

**Keywords:** graphene, nano-sepiolite, biosensor, electrochemistry

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4 , 5 December 2013

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# Electrochemical Determination of Lorazepam in Pharmaceutical Tablets

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## Abstract

Lorazepam, is an antianxiety agent. It is in a group of drugs called benzodiazepines that includes diazepam, clorazepam, flurazepam and others. The electrochemical reduction of Lorazepam was studied at a dropping mercury electrode (DME) using cyclic voltammetry (CV) and differential pulse polarography (DPP). The effect of pH, scan rate and analyte concentration has been examined. Under optimum experimental conditions, the calibration curve was linear in the concentration range of 0.5-15 mg/ml. Cyclic voltammograms of Lorazepam were obtained at dropping mercury electrode over the pH range of 2-8. As the pH increases from 4, the reduction peak becomes sharper. The supporting electrolyte is acetate buffer with pH=4.7. An electrochemical determination method for Lorazepam in tablets is described, using the reduction peak of Lorazepam in DPP. Which gives signals due to the reduction of the –C=N- bond within a cathodic scan with Ep= -870 mV. This method is compared with routine UV-spectrophotometric method.

### Keywords

Lorazepam, differential pulse polarography, cyclic voltammetry

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A Novel Enzyme-free Amperometric $H_2O_2$ Sensor based on Functionalized MWCNTs Decorated with Copper Nanoparticles

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## Abstract

Functionalized-multiwall carbon nanotubes decorated with redox active copper nanoparticles have been successfully fabricated for sensitive nonenzymatic $H_2O_2$ detection. Transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS) and electrochemical impedance spectroscopy (EIS) were used to give a complete characterization of the modified electrodes. The modified electrode showed well defined and stable redox couples signal with excellent electrocatalytic activity for oxidation of hydrogen peroxide. The response of the modified electrode to $H_2O_2$ was examined using amperometry at –0.45 V in a phosphate buffer solution (pH=10.0). Amperometric detection of $H_2O_2$ indicated a calibration plot linear up to 500 µM. The proposed sensor showed good selectivity for $H_2O_2$ detection in the presence of ascorbic acid, uric acid, citric acid, glucose and sucrose. The ability of the sensor for analyses in real sample was demonstrated by the detection of $H_2O_2$ presents in milk samples with appreciable recovery values.

**Keywords:**

Amperometric sensor; Hydrogen peroxide; Copper nanoparticles; MWCNTs

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthsis of NiO, MgO, ZnO nanoparticles and investigation of them in charge transfer resistan reduction using electrochemical impedance spectroscopy

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**Abstract**

In this research we offer chemical precipitation method as a simple and easy method for synthesis of ZnO nanoparticle, NiO nanoparticle and MgO nanoparticle in low size. Synthesis of metal oxide nanopowders was done in a good laboratory condition. Nanopowders properties are identified by EDAX, XRD, SEM, and TEM. The results obtained confirm the presence of Zinc oxide nanopowders, NiO nanopowders and MgO nanopowders produced during chemical precipitation. Result shows in ration of 0.25 to 0.5 of nitrate salt to NaOH diameter of ZnO nanoparticle was 22.0 nm, NiO nanoparticle 12 nm and MgO nanoparticle 30 nm that it was better compare to other condition. We used calcinations temperature at 330, 250 and 400 0C for calcinations temperature for NiO nanoparticle, ZnO nanoparticle and MgO nanoparticle, respectively. In continuous, synthesis condition after and before calcinations investigate in this work. Finally, the effect of synthesis nanoparticle for reduction of charge transfer resistance at a conductive support such as electrode investigates using electrochemical impedance spectroscopy method. Result shows that NiO nanoparticle has more effect for this investigation. The compare of charge transfer resistance between three nanoparticles shows good ability of them for preparation a voltammetric sensor for biological and pharmaceutical compound analysis.

**Keywords:** Nio Nanoparticle; ZnO nanoparticle; MgO nanoparticle; electrochemical impedance spectroscopy

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical deposition of Ag nanoparticles onto glassy carbon electrode for determination of cysteine

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## Abstract

Cysteine is an amino acid which occurs in proteins. Cysteine which contains a thiol (–SH) group, plays an important role in many functions of mitochondrial membranes, in membrane transport and especially in enzyme catalysis. Cysteine strongly adsorbs onto Ag nanoparticle via an Ag-sulfide linkage.

Nanoparticles (NPs) can play an important role in improving sensor performance due to their large specific surface areas, excellent conductivities and biocompatibilities. AgNPs modified electrode has some advantages such as the simple and quick preparation and the formed AgNPs are roughly spherical in shape and could be uniformly distributed all over the substrate. Therefore, this AgNPs modified electrode shows low expense of fabrication and operation simplicity, and meanwhile is easy to achieve good catalytic effect, stability and reproducibility

In this approach, Ag nanoparticles have been synthesized by using electrochemical method at the surface of glassy carbon electrode. The effects of deposition time and deposition potential have been investigated to preparation of Ag nanoparticles. The characterization of nanoparticles has been performed by using scanning electron microscopy (SEM), cyclic voltammetry (CV) and electrochemical impedance spectroscopy. The fabricated electrode has been applied for quantitative determination of cysteine. The decreasing of Ag oxidation peak current was related to cysteine concentration. The dynamic linear range between $10^{-6}$-$5\times10^{-4}$ M was obtained. The electrode will be used for determination of real samples such as human serum and urine.

**Keywords:** Ag nanoparticles; electrochemical deposition; cysteine; voltammetric sensor;

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Modified electrochemical sensor based on nanoparticles-imprinted sol-gel on the surface of pencil graphite electrode for sensitive determination of Papaverine

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## Abstract

In the present study, a simple, accurate and sensitive electorchemical sensor is proposed for rapid determination of Papaverine hydrochloride (Papa) as a vasodilators to relaxes veins and arteries. Pencil graphite electrode (PGE) which was modified by a multiwall carbon nanotube (MWCNTs), a thin film of molecularly imprinted polymer (MIP) and deposition of Au-nanoparticles (AuNPs). To description of this sensor Characterization were used methods for instance Square wave voltammetry (SWV), Electrochemical impedance voltammetry (EIS) and Cyclic voltammetry (CV), Field emission scanning electron microscopy (FE-SEM). The calibration curve was plotted in two linear range from 0.001 µM~ 0.1 µM and 0.1 µM ~ 5.0µM, with a detection limit (S/N=6) of 0.32 nM. This sensor illustrated high sensivity, selectivity and quick response towards papa. We successfully determinated Papa in serum and human urine samples.

**Keywords:** Papaverine hydrochloride; Imprinted sol-gel polymers; Pencil graphite electrode

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Nano-Composite carbon paste electrode based on 2, 2'-Dithiobis (4-methylthiazole) for $Lu^{3+}$ ion detection

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## Abstract

2,2'-Dithiobis(4-methylthiazole) has been used as a suitable ionophore in order to develop a Nano-composite Carbon Paste electrode for $Lu^{+3}$ detection. The electrode was modified by multi-walled carbon nano-tube and nano-silica to improvement in their characterizations such as sensitivity and selectivity, response time and lifetime in comparison with typical carbon paste electrodes. The best performance for nano-composite sensor was obtained with electrode composition of 25%paraffin oil, 3%TMT, 3%MWCNTs, 0.5%nano-silica, 40%graphite. The sensors exhibits Nernstian response for the $Lu^{3+}$ ions over the concentration range $5.0\times10^{-8}$-$1.0\times10^{-2}$ M at pH 2.8-9.3 with a lower detection limit of $2.5\times10^{-8}$ M and the slope of 19.9±0.3 mV/decade. The response time was relatively quick in the whole concentration range (<10 s). The sensor revealed high selectivity with respect to all common alkali, alkaline earth, transition and heavy metal ions. The electrode was used as an indicator electrode in the potentiometric titration of $Lu^{+3}$ ions with EDTA.

**Keywords:** ion selective electrode; potentiometric electrode; carbon paste

**9th Iranian Annual Seminar of Electrochemistry**

4 , 5 December 2013

Tehran, Iran University of Tarbiat Modares,

# Preparation of a carbon paste electrode based on Di-tert-butyl-1-(tert-butyl thio)-1,2-hydrazine dicarboxylate.

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## ABSTRACT

Di-tert-butyl-1-(tert-butyl thio)-1,2-hydrazine dicarboxylate (DBHC) as an ionophore can form a selective complex with lutetium ions in preparation of a nanocomposite carbon paste electrode. The carbon paste electrode composed of 3% multi-walled carbon nanotube ( MWCNT), 0.5% nanosilica (NS), 3% DBHC, 25% Parafin, and 68.5% graphite powder showed the best response. Nernstian response of (20.3±0.6 mV decade$^{-1}$) in the concentration range of 5.0× $10^{-8}$ -1.0×$10^{-2}$ M with a detection limit of 3.5×$10^{-8}$ M was achieved. The response of the electrode was pH independent in the range of 2.5-8.6. The proposed Lu(III) nano-composite carbon paste sensor displayed good selectivity, fast response time ( ~7 s). the membrane sensor was employed as an indicator electrode in the potentiometric titration of Lu (III) ions with EDTA.

**Keywords:** carbon paste, multi-walled carbon nanotubes, nanosilica sensor

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares,Tehran, Iran

# Potentiometric investigation of-methylimidazole /2,6-dipicolinic acid proton transfer system and it′s complexation with $Zr^{4+}$and $Nd^{3+}$ ions

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## Abstract

In this work stability constants of 1-methylimidazole(1-mim ) and 2,6-pyridinedi carboxylic acid (2, 6-pydc) proton transfer systems and complexes with $Zr^{4+}$ and $Nd^{3+}$ ions has been studied by potentiometric method. All steps of titrations carried out in 25.0±0.1 ˚C and I=0.1 M $NaNO_3$ Legends' protonation constants and stability constants of proton transfer and its metal complexes were evaluated by computer refinement of the pH- Volume titration data using the BEST computer program. The distribution diagram of all systems as a function of pH was depicted by using Hyss 2009 program The most likely species were obtained from distribution diagrams. And the results compared with obtained information in solid state.

**Keywords**: 1-methyl imidazole, 2, 6-pyridinedicarboxylic acid, potentiometric investigation

In near past the interactions between pyridine-2, 6-dicarboxylic acid, 9-aminoacridine and 1,10-phenanthroline were considered [1,2] but the interaction of this acid with other bases such as imidazole derivatives wasn't report. In this work the protonation constants of pydc and 1-mim the equilibrium constants for the pydc/1-mim proton transfer system and stoiciometry and stability of complexation of this system with $Zr^{4+}$ and $Nd^{3+}$ ions in aqueous solutions. It is interesting to note that the stoichiometries of the some of the most abundant ternary complexes such as for Zr: $ZrL_3QH.ZrL_3QH_2$,$ZrL_3QH_3$ and for Nd: $NdL_3QH$ $NdL_3QH_2$ $NdL_3QH_3$ existing in solution, are very similar to those reported for the corresponding isolated complexes in the solid state.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Study of dipicolinic Acid / 2,2'- diprydilamine proton-transfer system by potentiometric method

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## Abstract

The protonation constants of pyridine-2,6-dicarboxylic or Dipicolinic Acid (dipic) an 2,2'-diprydilamine (DPA),the equilibrium constants for dipic-DPA (1:1) proton transfer system were calculated by potentiometric *p*H titration method using Hyperquad2008 program.The stoichiometries of the proton transfer species in solution confirm the solid state result.

**Keywords:** Proton transfer, Dipicolinic acid, 3,4-diaminopyridine, Solution studies

The protonation constants of dipic [1] and DPA [2] were calculated by fitting the volume-pH data. It is noteworthy that the resulting protonation constant values are in satisfactory agreement with those reported in the literatures The cumulative stability constants of proton transfer species ($Q_qL_lH_{h)}$, $\beta_{qlh}$ is defined as:

$$qQ + lL + hH \xleftrightarrow{\beta_{qlh}} Q_qL_lH_h$$

$$\beta_{qlh} = [Q_qL_lH_h]/[Q]^q[L]^l[H]^h$$

There are L, Q and H as dipic, DPA and proton respectively and l, q and h are the respective stoichiometric coefficients. It is interesting to note that the $LQH_2$ species in aqueous solution with the high abundant (72.76%), are the same that is observed in the solid state.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Construction and comparison of $Lu^{3+}$ coated graphite and wire electrodes Based on 2, 2'-Dithiobis (4-methylthiazole)

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## Abstract

In this study, a comparison between a new coated graphite (CGE) and wire (CWE) electrodes is described for sensing Lutetium ion based on 2,2'-Dithiobis(4-methylthiazole) as an ionophore. The electrodes show Nernstian slope values of 19.0±0.2 and 19.4±0.6 mV/decade at 25 $^{o}$C, over the concentration ranges of $1.0\times10^{-7}$-$1.0\times10^{-2}$ M and $1.0\times10^{-7}$-$1.0\times10^{-2}$ M within the pH range of 3.0-8.9 and 3.4-8.5 with a lower detection limit of $8.5\times10^{-8}$ M and $7.0\times10^{-8}$ M for CGE and CWE, respectively. In both of electrodes the best performance was obtained with a membrane composition of 30%PVC, 2.0%TMT, 2.0%NaTPB and 66%AP. The CGE and CWE individually displayed a response time in the whole concentration range (~15 s, ~10 s). The recommended sensors revealed comparatively good selectivity with respect to most alkali, alkaline earth, some transition, and heavy metal ions. Both electrodes were successfully employed as an indicator electrode in the potentiometric titration of $Lu^{+3}$ ions with EDTA.

**Keywords:** ion selective electrode; PVC membrane; coated graphite electrode (CGE); coated wire electrode (CWE); potentiometric electrode

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Simultaneous voltammetricdetermination of droxidopa and carbidopa using a carbon nanotubes paste electrode

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## Abstract

Droxidopa is an international non-proprietary name (INN) for a synthetic amino acid precursor of norepinephrine, which was originally developed by Sumitomo Pharmaceuticals Co., Limited, Japan. It has been approved for use in Japan since 1989 [1]. Carbidopa is a DOPA decarboxylase (DDC) inhibitor [2]. At therapeutic doses carbidopa does not cross the blood-brain barrier and therefore should not inhibit CNS metabolism of droxidopa to norepinephrine. Decreasing the activity of DDC in the periphery enables droxidopa metabolism to be focused in the CNS. In this study, a carbon paste electrode modified with 5-amino-2'-ethyl -biphenyl-2-ol and carbon nanotubes was used to prepare a novel electrochemical sensor for the detection of droxidopa in the presence of carbidopa. The response of catalytic current with droxidopa concentration showed a linear relation in the range from $1.2\times10^{-7}$ to $2.25\times10^{-4}$ M with a detection limit of 50.0 nM.

**Keywords:** Droxidopa; Carbidopa; Carbon nanotubes; Electrocatalysis

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# A novel MgO/ionic liquid modified electrode for square wave voltammetric determination of methyldopa

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**Abstract**
Methyldopa is a catecholamine derivative and used as an old antihypertensive agent in the treatment of mild to moderate hypertension. It is converted to α-methyl norepinephrine in adrenergic nerve terminals and its antihypertensive action appears to be due to stimulation of central α-adrenoreceptors by this agent. Therefore, determination of this drug is very important. In this study we describe an ionic liquid–MgO nanoparticle modified carbon paste electrode (MgO/NPs/IL/CPE) was used as a simple, fast and sensitive tool for the investigation of the electrochemical oxidation of methyldopa (MDOP) using voltammetric methods. The MgO/NPs was characterized with different methods such as TEM, SEM and XRD. The oxidation peak potential of the MDOP at a surface of MgO/NPs/IL/CPE appeared at 450 mV that was about 100 mV lower than the oxidation peak potential at the surface of the traditional carbon paste electrode (CPE) under similar condition. The electro-oxidation of MDOP occurred in a pH-dependent $2e^-$ and $2H^+$ process, and the electrode reaction followed a diffusion-controlled pathway. Under optimal conditions at pH 7.0, the anodic peak currents increased linearly with the concentration of MDOP in the range of 0.08–380 μmol $L^{-1}$ with a detection limit of 0.03 μmol $L^{-1}$ (3σ). The proposed sensor was successfully applied to the determination of MDOP in real samples such as drug and urine.

**Keywords:** Methyldopa, Ionic liquid, MgO nanoparticle, Sensor

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Ionic liquid modified NiO/CNTs carbon paste electrode for simultaneous determination of morphine and diclofenac

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**Abstract**
Diclofenac as a nonsteroidal anti-inflammatory drug has been shown to decrease morphine consumption after operation in adults. The addition of regular doses of diclofenac may reduce the need for morphine after abdominal surgery [31]. Therefore, the design of a simple, fast and inexpensive method for determination of these compounds in biological and pharmaceutical samples seems essential. To the best of our knowledge, only one study has been reported on the voltammetric determination of morphine in the presence of diclofenac using modified electrodes, which is the focus of the present study. Compared with previous report for determination of diclofenac using vinylferrocene/multiwall carbon nanotubes paste electrodes; the modified electrode has not any mediator in electrode matrix and simple prepared. Also, the propose sensor has the comparable dynamic range, limit of detection and sensitivity for morphine and diclofenac analysis. So, in this study a novel ionic liquid modified NiO/CNTs carbon paste electrode (IL/NiO/CNTCPE) had been fabricated by using hydrophilic ionic liquid 1-methyl-3-butylimidazolium chloride [MBIDZ]Cl as a binder. The cyclic voltammogram showed an irreversible oxidation peak at 0.61 V (vs. $Ag/AgCl_{sat}$), which corresponded to the oxidation of morphine. Compared to common carbon paste electrode, the electrochemical response was greatly improved for morphine electrooxidation. This modified electrode exhibited a potent and persistent electron mediating behavior followed by well separated oxidation peaks of morphine and diclofenac. Detection limit of morphine was found to be 0.01 µM using square wave voltammetry (SWV) method. The proposed sensor was successfully applied for the determination of morphine in human urine and pharmaceutical samples.

**Keywords:** Diclofenac, Morphine, Ionic liquid, NiO/CNTs nanocomposite, Sensor

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical Determination of Antimony using Carbon Paste Electrode Modified with Carbon Nanotubes

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## Abstract

A sensitive method is described for the determination of trace amounts of antimony based on the antimony–bromopyrogallol red (BPR) analysis in surface of carbon paste electrode modified with functionalized multi-walled carbon nanotubes (MWCNT/CPE). The analysis involved a three-step procedure: accumulation, reduction and anodic stripping. The anodic peak current of antimony at MWCNT/CPE is several times greater than the unmodified electrode. The best results using the modified electrode were obtained in pH=2 phosphate buffer solution in +0.48 V. This sensor presented good selectivity towards the Sb(III) over a wide variety of cations. Under the optimum conditions, the calibration curve was linear in the range of 0.01-14.0 ng $mL^{-1}$ with limit of detection of 0.0033 ng $mL^{-1}$ and relative standard deviation of 1.03% at 8.0 ng $mL^{-1}$ (n=5). The proposed electrode was successfully used as a voltammetric sensor for determination of antimony in water samples.

**Keywords:**
Modified carbon paste electrode, Carbon nanotubes, Stripping voltammetry, Antimony determination

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Ordered carbohydrate-derived porous carbons immobilized gold nanoparticles as a new electrode material for catalytic oxidation and determination of nicotinamide adenine dinucleotide

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**Abstract**

The ordered carbohydrate-derived porous carbons (OC-DPCs) was firstly functionalized with thiol groups (−SH) and then was immobilized with gold nanoparticles (AuNPs) for the fabrication of new electrochemical sensor (Au-SH-OC-DPCs) and characterized it by CHN analysis, transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FT-IR), X-ray photoelectron spectroscopy (XPS), and x-ray diffraction (XRD). The electrocatalytic capabilities of Au-SH-OC-DPCs were tested by the oxidation of nicotinamide adenine dinucleotide (NADH) in a 0.1 M robinson buffer solution pH 7.0 using cyclic voltammetry. The Au-SH-OC-DPCs showed good voltammetric performance toward the electrochemical detection of NADH with a low value of detection limit, high sensitivity, and wide linear concentration range.

**Keywords**: Mesoporous carbon materials; Ordered carbohydrate-derived porous carbons; Gold nanoparticles; Electrochemical biosensor, Nicotinamide adenine dinucleotide.

9th Iranian Annual Seminar of Electrochemistry
4 , 5 December 2013
Tehran, Iran University of Tarbiat Modares,

# Metal oxide nanoparticles/Conducting polymer Composite: Electrosynthesis and Characterisation

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## Abstract

Inorganic nanoparticles of different nature and size can be combined with the conducting polymer, giving rise to a host of nanocomposite with interesting physical properties and important application potential**.** Extensive research has been reported involving various inorganic particles, such as, calcium carbonate, silica, titanium dioxide, carbon black and magnetite with either micrometer or nanometer sizes. Among these materials, $TiO_2$ is biocompatible, stable, and environmentally friendly and its electronic, optical, and dielectric properties can be enhanced by surface Modifications. They have widely been used as fillers for polymers for improvement of the dielectric properties.

To inspect the influence of $TiO_2$ nanoparticles on the electropolymerization of tyramine, this process was monitored on a conventional substrate electrode but in dispersed $TiO_2$ presence in the solution and then sonicated to obtain a uniform dispersion. Poly tyramine (PT) composite with different particle size was deposited on a graphite electrode by means of CV method.

Cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS), galvanostatic charge-discharge study show that the films of nanocomposite exhibiting high specific capacitance and a novel modified electrode with semiconducting properties are obtained.

In summary, we have demonstrated a simple and general strategy, namely in situ electropolymerization by using the ionic surfactant as electrolyte. Surfactant SDS has played a key role in the synthesis of conducting polymer/$TiO_2$ nanocomposite films. We have introduced the $TiO_2$/PT composite electrode to improve the specific capacitance and power characteristic of electrochemical capacitance. The $TiO_2$ has an obvious improvement effect, which makes the composites have more active sites for faradic reaction and larger specific capacitance than pure PT.

**Keywords:** nanocomposite, PT, $TiO_2$, impedance

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical Studies of Dopamine Based on Graphene Platelet Modified Electrode

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## Abstract

As a member of catecholamine family, dopamine (DA) plays an important role in hormonal, renal, cardiovascular and central nervous systems [1,2]. Electrode surface modification has been widely used to improve the electrochemical responses of biological compounds. Graphene oxide (GO), oxidative derivative of graphene have good biocompatibility, high electronic features and amphiphilic in nature distinct from other graphitic systems [3]. Owing to these unique advantages of GO, we used it to prepare a graphene oxide modified carbon paste electrode (GO/CPE). Characterization of the modified electrode was investigated using electrochemical impedance spectroscopy. Also different electrochemical techniques such as cyclic voltammetry, linear sweep voltammetry and chronocoulometry were used for electrochemical studies of DA. Using these techniques diffusion coefficient ($D=9.2\times10^{-5}cm^2s^{-1}$), electron transfer coefficient ($\alpha=0.6$) and exchanging current density ($j_0=14.6\mu Acm^{-2}$) for DA were determined. Also using differential pulse voltammetry technique a linear dynamic range with a detection limit of 8.59 nM was obtained for DA.

**Keywords:** Graphene oxide, Dopamine, electrochemical impedance spectroscopy, Voltammetric techniques

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Determination of Hg(II) ions from aqueous solution applying solid phase extraction by $Fe_3O_4$ magnetic nanoparticles modified with poly(1,8-diaminonaphthalene) followed by anodic stripping voltammetry on screen-printed electrode

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**Abstract**

Solid phase extraction (SPE) coupled to electrochemical detection on screen-printed carbon electrode has been developed for the quantification of mercury ions in aqueous samples. Mercury ions were extracted from aqueous sample using Iron(II,III) oxide magnetic nano particles modified with poly(1,8-diaminonaphthalene) [$Fe_3O_4$/PDAN] as a sorbent. The adsorbed mercury ions were removed from the polymeric matrix using 1 mL of HCl (0.1 mol $L^{-1}$) as the eluent. Then, in order to determine the concentration of mercury ion, this solution was analyzed using screen printed electrochemical strip. Differential pulse voltammetry (DPV) peak current at 0.10 V was selected as signal and the influence of experimental parameters affecting the adsorption and desorption steps were investigated and optimized using one-variable-at-a-time methodology as follows: pH of the sample solution, 7; amount of the sorbent, 10 mg; adsorption time, 10 min; type of the eluent, HCl; concentration of the eluent, 0.1 mol $L^{-1}$; volume of the eluent, 1 mL and desorption time, 5 min. Finally, a calibration curve was plotted by the variation of DPV currents as a function of mercury concentration which was linear within the range of 1.0-1000.0 ng $mL^{-1}$. The limit of detection and the limit of quantification were 0.30 (S/N = 3) and 1.0 ng $mL^{-1}$, respectively.

*Keywords*: Mercury; Polymer based solid phase extraction; Magnetic preconcentration; Screen printed electrode; Electrochemical determination

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Determination of diffusion coefficient and size of Gemini surfactants aggregates by cyclic voltammetry

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## Abstracts

Cationic geminis are used as promising surfactants in detergency, the best ion exchangers on silica surfaces compared to nonionic and anionics [1] and have shown efficiency in skin care, antibacterial property and vesicle formation [2]. In this work, the aggregation behavior of ester-containing cationic gemini surfactants, dodecyl esterquat and dodecyl betainate geminis were investigated using surface tension, electrical conductivity and cyclic voltammetry (CV) measurements at 298K. Different physicochemical properties such as the critical micelle concentration (CMC), degree of counterion dissociation ($\alpha^{diss}$), interfacial properties, size of aggregates, and interparticle interaction parameters were determined. The results showed that the chemical structure of gemini surfactants have significant effect on the aggregation behavior and the thermodynamics of micellization. It was observed a phase transition with concentration for both Gemini surfactants.

**Keywords:** Gemini surfactant, Esterquats, Betainesters, Cyclic voltammetry

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Simultaneous Determination of Tryptophan and Tyrosine Assisted by Chemometric Methods at the Surface of Gold Nanoparticles Modified Electrode

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## Abstract

In the present work differential pulse voltammetry coupled with multivariate calibration methods was applied for simultaneous determination of tryptophan and tyrosine in phosphate buffer solution at the surface of a gold nanoparticles modified carbon paste electrode. Characterization of the modified electrode was carried out by electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV). A strategy based on experimental design was followed. Operating conditions were improved with central composite rotatable design (CCRD) and response surface methodology (RSM), involving several chemical and instrumental parameters. The optimized values for pH, scan rate and step potential were obtained 2.0, 0.185 V $s^{-1}$ and 0.001 V, respectively. Then quantitative analysis and detection limits for simultaneous determination of two amino acids in the surface of modified electrode were determined using differential pulse voltammetry (DPV) asisted by multivariate calibration methods. The proposed method was successfully applied in simultaneous determining the two analytes in real sample.

**Keywords:** Multivariate calibration methods ; Differential pulse voltammetry; Central composite rotatable design

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Optimization of Ni electroless coating condition on ABS polymer surface

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## Abstract

Acrylonitrile butadiene styrene(ABS) is a type of plastic and does not have, under normal conditions, conductive property. In this investigation the dissertation covers carried out on the optimizing conditions for electroless of ABS plastic surface by nickel.. Stages Etching. In this stage ABS was immersed in the solution at 60˚c for 5 minutes Activation: ABS was put in a solution of concentrated hydrochloric acid which contained 30g/l of tinchloride. It was, then washed by distilled water, and finally immersed in a solution of 37% hydrochloric containing 0.5g/l of palladium chloride at 60˚c to assist palladium atoms become activated and absorbed on the surface ABS and into its pores. Clearing: At this stage the surface of the ABS was contaminated by ions of chlorine and tin which were removed by a solution of 25% sulphuric acid at a temperature of 60˚c. Nickel electroless deposition: In this stage nickel, as a result of an auto catalytic chemical reaction, became Precipitated on the surface of ABS. after above processes, the ABS none conductive property, was changed to conductive one.

**Keywords:** Acrylonitrile butadiene styrene; Coating; Electroless

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Construction of $Tb^{3+}$ coated graphite and wire electrodes Based on 1, 3-Diaminopropane-N, N, N', N'-tetraacetic acid

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## Abstract

A new terbium(III) coated Graphit and wire electrode has been constructed by using 1,3-Diaminopropane-N,N,N',N'-tetraacetic acid as an ionophore, NaTPB as an anionic additives, and were tested by using different solvent mediators such as benzyl acetate(BA), nitrobenzene(NB), dibutyl phthalate(DBP), and acetophenon(AP). The best performances in both of them were obtained with a membrane containing 30%PVC, 65%NB, 3%DAPTA and 2%NaTPB. The coated wire electrode display a linear dynamic range between $5.0\times10^{-9}$-$1.0\times10^{-2}$ M within the pH range of 3.0-8.7, with a Nernstian slope of 19.6 mV/decade and a detection limit of $2.8\times10^{-9}$ M. The coated Graphit electrode display a linear dynamic range between $5.0\times10^{-9}$-$1.0\times10^{-2}$ M within the pH range of 2.4-8.9, with a Nernstian slope of 19.47 mV/decade and a detection limit of $3.5\times10^{-9}$ M. The coated Graphit and Wire electrode display a fast response time (~17s, ~10s). They were used as an indicator electrode in the potentiometric titration of Tb(III) ions with EDTA.

**Keywords:** PVC membrane; coated graphite electrode (CGE); coated wire electrode (CWE); ion selective electrode;

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrodeposition of silver thin films for electrochemical sensing of hydrogen peroxide

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## Abstract

Determination of hydrogen peroxide traces is an important issue due to the fact that $H_2O_2$ plays a crucial role in many fields including foods and agriculture products, cosmetic and pharmaceutical components, chemical and biochemical industry, clinical control, environmental protection, and fuel cells. Many analytical methods have been employed for the determination of $H_2O_2$, including titrimetry, spectrophotometry and chemiluminescence. These techniques are usually time-consuming and expensive. Among these, electrochemical methods are superior for their low detection limit, high selectivity and sensitivity and low cost. Silver nanstructures films have been widely used in electrochemical detectors, owing to their unique properties like excellent conductivity, extra ordinary electrocatalytic property, larger specific surface area, relative low cost than the other noble metals, biocompatibility and low toxicity. Currently, nanostructured silver are mostly used in the form of thin film, which have found potential applications in many fields such as optical coatings, electronics, sensors and catalysis. Silver nanoparticles show excellent electrocatalytic activity to $H_2O_2$. In this approach, thin silver films were prepared by electodeposition method. Thin silver films were electrodeposited onto tin doped indium oxide (ITO) surfaces as substrate in 0.1 M $KNO_3$ solution containing 1.0 mM $AgNO_3$ at 0.1 V (vs. Ag/AgCl). The deposition time and potential were optimized. The electrochemical measurements have been performed by using cyclic voltammetry. The results indicate the good electrocatalytic activity of silver thin films as sensors towards the reduction of hydrogen peroxide in phosphate buffer solution that proportionated with $H_2O_2$ concentration. With the increase of $H_2O_2$ concentration, the $H_2O_2$ reduction current gradually increases and the peak potential was also positively shifted with the increase of $H_2O_2$ concentration. Also these new type of electrodes are capable for sensing of other biological and enzymatic compounds like glucose.

**Keywords:** Electrodeposition; Silver thin film; Hydrogen peroxide.

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical studies of hydroxycholoroquine in biological fluids using multi wall carbon nano tube modified carbon paste electrode

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## Abstract

Hydroxychloroquine (HCQ) is a potent antimalarial drug also being used frequently as antirheumatic substance [1-3]. In this research, electrochemical behavior of HCQ in real samples was investigated at the surface of carbon paste electrode modified with multi wall carbon nanotubes (CPE/MWCNTs). The characterization of CPE/MWCNTs was investigated by cyclic voltammetry (CV). Then, the electrocatalytic oxidation of HCQ at the surface of CPE/MWCNTs was studied by CV, chronoamperometry, chronoqoulometry and differential pulse adsorptive stripping voltammetry methods. The diffusion coefficient and the kinetic parameters such as electron transfer coefficient and exchanging current density for HCQ were determined using electrochemical approaches. Then, by differential pulse adsorptive stripping voltammetric method calibration curve of HCQ was obtained and showed two linear ranges, with the detection limit of 6.0 nm. Finally, the prepared electrode was successfully applied for determination of HCQ in pharmaceutical tablets and blood plasma samples.

**Keywords:** Hydroxychloroquine, Modified Carbon Paste Electrode, Multi-Walled Carbon Nanotubes, Voltammetry Methods , Biological Fluids.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrosynthesis, characterization and electrocatalytic properties of Pt-Fe nanoparticles towards the oxidation of methanol

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## ABSTRACT

Bimetallic Platinum-Iron alloy nanoparticles modified carbon-ceramic electrode as an electrocatalyst was prepared by a two-step procedure: (I) the carbon-ceramic electrode (CCE) was produced by using sol-gel technique and (II) Platinum-Iron nanoparticles alloy was deposited electrochemically on the surface of CCE and the resulting modified electrode was referred as Pt-Fe/CCE. The obtained electrocatalyst, Pt-Fe/CCE, was characterized by scanning electron microscopy, energy-dispersive X-ray spectroscopy, X-ray diffraction and cyclic voltammetry. The electrocatalytic activity of the Pt-Fe/CCE towards the electrooxidation of the methanol was evaluated by cyclic voltammetric technique in 0.1 M of $H_2SO_4$ solution. It was found that the Pt-Fe/CCE was catalytically more active than Pt nanoparticles (alone) supported on the same substrate. The obtained results also showed that the presence of Fe atoms greatly enhance the activity of the Pt towards the electrooxidation of methanol. Moreover, it contributes to reduce the amount of the noble metal in the anode of direct methanol fuel cells (DMFCs), which remains one of the challenges to make the technology of DMFCs economically viable.

**Keywords:** Methanol, nanoparticles, Pt-Fe alloy, Carbon-ceramic, Electrooxidation

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Determination of Fenoprofen in urine and human plasma by Adsorptive Stripping Voltammetry

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## Abstract

Fenoprofen is one of the nonsteroidal antiflammatory drugs (NSAID), which are used in the management of mild to moderate pain, fever and inflammation processes, whereas their antitumor potential has acquired limited attention to date [1,2,3].

a novel selective and sensitive method for determination of fenoprofen by adsorptive stripping voltammetry is presented. The method is based on adsorptive accumulation of the fenoprofen onto hanging mercury drop electrode (HMDE), followed by reduction of adsorbed species by differential pulse voltammetry. Optimal conditions were obtained, accumulation potential 0.15 V, accumulation time of 40 s, and scan rate of 120 mV/s. Under the optimized conditions, linear calibration curves were established for the concentration of fenoprofen in the range of 0.418- 52.26 µg/mL, with detection limit of 0.081µg/mL. The procedure was successfully applied to the determination of fenoprofen in biological samples (urine, plasma).

Various methods, like HPLC [4], GLC [5], and capillary isotachophoresis [6], using for determination of fenoprofen but At this time there is no report on the direct determination of fenoprofen with any electrochemical method.

**Keywords**: Fenoprofen, Adsorptive Stripping Voltammetry, Biological samples

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

Tehran, Iran University of Tarbiat Modares,

# Determination of Amoxicillin in urine and pharmaceutical Samples by Adsorptive Stripping Voltammetry

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## Abstract

Antibiotics of the β-lactam group are important antimicrobial agents that are widely used to treat infectious human and animal diseases and to enhance growth and yield in agriculture. [1]

An adsorptive stripping voltammetric method was developed for determination of amoxicillin onto hanging mercury drop electrode (HMDE). Optimal conditions were obtained at pH 10.2, accumulation potential of 0.15 V (vs. Ag/AgCl), accumulation time of 60 s, and scan rate of 120 mV/s. Under the optimized conditions, a linear calibration curve was established for the concentration of amoxicillin in the range of 0.07-5 µ M with a detection limit of 0.0098 µ M. The procedure was successfully applied to the determination of amoxicillin in various medicine and biological samples.

Various methods, like spectroscopy [2], capillary electrophoresis [3], high-performance liquid chromatography [4], electrochemical methods [5] using for determination of amoxicillin. At this time there is no report on the determination of amoxicillin with adsorptive stripping voltammetry.

**Keywords**: Amoxicillin, Adsorptive Stripping Voltammetry, Real samples

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**Tehran, Iran University of Tarbiat Modares,**

# Construction of Selective Membrane Electrodes based on Di-tert-butyl-1-(tert-butyl thio)-1,2-hydrazine dicarboxylate

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## ABSTRACT

Two types of electrodes: coated wire (I),and coated graphite (II), using Di-tert-butyl-1-(tert-butyl thio)-1,2-hydrazine dicarboxylate(DBHC) as an ionophore have been developed as a Lutetium ion-selective electrodes. The membrane solutions composed of %30 PVC,% 66 of NB,% 2 NaTPB and %2 of ionophore in 2 mL of THF. The electrodes exhibit Nernstian response in the concentration range of $1.0\times10^{-7}$-$1.0\times10^{-2}$ M and detection limit of $8.0\times10^{-8}$ M , $8.5\times10^{-8}$ M for electrode I, II respectively.They display a Nernstian slope of 19.8±0.2 mV/decade, 20.2±0.2 mV/decade *and can be used in the pH range of* 2.7-8.4 , 2.9-7.8 for electrode I, II respectively. The proposed sensores also exhibit a fast response time.The electrodes(I,II) were used as an indicator electrode in the potentiometric titration of Lu(III) ions with EDTA.

**Keywords:** Ion-Selective Electrode, coated wire , Potentiometry, coated graphite

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical oxidation of formic acid at palladium and tin modified palladium coated nanoporous gold film electrode

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## Abstract

Fabrication and developing of energy converter with lower pollution have attracted much attention. In this line, much research has been devoted to develop suitable catalyst for formic acid fuel cell. In this research, Tin-palladium coated nanoporous gold film electrode (Sn-Pd/NPGFE) is fabricated as a catalyst for electrooxidation of formic acid. The NPGF is prepared by anodization of the gold substrate under high potential followed by treatment in aqueous ascorbic acid solution. The NPGF substrate is used for the preparation of Pd/NPGFE by underpotential deposition of Cu (UPD-Cu) and galvanic replacement of Cu with Pd. Then a submonolayer of Sn is electrodeposited on Pd/NPGFE. The result of electrochemical oxidation of formic acid at Sn-Pd/NPGFE is studied by cyclic voltammetry (CV) and chronoamperometry (CA) techniques and the results compared with those of Pd/NPGFE. The results show significantly higher electrocatalytic activity and stability, and lower onset potential for Sn-Pd/NPGFE in the electrooxidation of formic acid.

**Keyword**: Nanoporous, Electrooxidation, Formic acid, Under potential deposition, Galvanic replacement

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# Graphene-Manganase Oxide Nanocomposite for Prearation of Hydrogen Peroxidase Biosensore

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Abstract:

A feasible and fast method to fabricate hydrogen peroxide sensor was investigated by graphene-manganase nanocomposite carbone paste electrode as a peroxidase biomimetic. In the recent years, graphene has great interest among in the fields of materials science, physics, chemistry and biology. This allotrope of carbon comprises layers of six-atom rings in a hexagonal configuration with atoms bonded by sp2 bonds [1-2]. As a basic building block of other carbon allotropes, graphite can be wrapped to generate 0D fullerenes, rolled up to form 1D carbon nanotubes, and stacked to produce 3D graphite. In the present work, in first step, the graphene was synthesis by chemical method and in second step manganese oxide nanoparticle was doped on graphene. graphene-manganase nanocomposite was characterized by FT-IR and SEM. The nanocomposite shows a high conductive and sensitivity for hydrogen peroxide determination as shown by cyclic voltammetry and electrochemical impedance spectroscopy. graphene-manganase nanocomposite carbone paste electrode was used for sensing of hydrogen peroxide by choronoamperometry with a potential of 250 mV (Ag/AgCl), in 0.1 M phosphate buffer solution at pH=7. The linear concentration rang of sensor is 0.14–3.14 µM, and with detection limit of 0.04 µM. Also, the life time of sensor is infinite.

Keywords: graphene manganese oxide nanoparticle, sensor, electrochemistry

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# A Facile Approach for In Situ Synthesis of Nickel Oxide Nanoparticles at Multiwalled Carbon Nanotube Modified Screen Printed Electrode for Insulin Determination

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Insulin is a polypeptide hormone that contains one intra chain and two inter chain disulfide bonds [1]. The direct monitoring of insulin in a diabetic patient has a better prospect in clinical investigation rather to the glucose measurement [2].

In this work, Nickel oxide nanoparticles modified nafion-multiwalled carbon nanotubes screen printed electrode (NiONPs/Nafion-MWCNTs/SPE) were prepared using pulsed electrodeposition of NiONPs on the MWCNTs/SPE surface. The size, distribution and structure of the NiONPs/Nafion-MWCNTs were characterized by TEM and XRD and also the results show that NiO nanoparticles were homogeneously electrodeposited on the surfaces of MWCNTs. Also, the electrochemical behavior of NiONPs/Nafion-MWCNTs composites in alkaline solutions of insulin was studied by CV, CA and EIS. Cyclic voltammetric studies showed that the NiONPs/Nafion-MWCNTs film modified SPE, lowers the overpotentials and improves electrochemical behavior of insulin oxidation. Amperometry was also used to evaluate the analytical performance of modified electrode in the quantitation of insulin. Excellent analytical features, including high sensitivity (1.8343 μA/μM), low detection limit (6.1 nM) and satisfactory dynamic range (20 nM – 0.26 μM) were achieved. Moreover, these sensors show good repeatability and a high stability after a while or successive potential cycling.

**Keywords:** Insulin; Nickel Oxide Nanoparticles; Amperometric Detection; Electrodeposition; Screen Printed Electrode

**Reference:**

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# A Sensitive Electrochemical Determination of Te with A New Multi-Walled Carbon Nanotube Paste Electrode

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## Abstract

We describe a Te(IV)-selective carbon paste electrode modified with multi-walled carbon nanotubes and Alizarin Red S acts as a chelating agent, and its electrochemical response to Te(IV). Effects of reduction potential and time, accumulation time, pH of the solution and the stripping medium were studied by differential pulse anodic stripping voltammetry and optimized. The findings resulted in a method for the determination of tellurium over a linear response range (from 2.0 to 300 ng $mL^{-1}$) and with a detection limit as low as 0.45 ng $mL^{-1}$. The sensor displays good repeatability (with the RSD of ±2.95 % for 7 replicates) and was applied to the determination of Te(IV) in water samples and certified reference materials.

**Keywords*:* Carbon nanotube; Anodic stripping voltammetry; Modified carbon paste electrode; Te(IV)**

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# Nano electro copolymerization of aniline and 2,4-dinitrophenol in presence of potassium chloride and *para* toluene sulfonic acid

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## Abstract

Nontechnology is developed more than half of century. Improved electrodes because of their specific application are so important. poly aniline as a conductive nano polymer have significant properties such as electrical conductivity, opticity and electro activity[1-2]. PAni is relatively stable in air, even at elevated temperature, much better than polyacetylene. However, its intractable nature, such as insolubility, high brittleness, conductivity, and electrochemical activity that depend on the medium's pH, acid-catalyzed oxidative degradation, etc [3]. The electro nano homo and copolymerization of aniline (Ani) and 2,4,dinitrophenol (DNP) was performed on composite 2B pencil graphite (CG) electrode using 10ml solution containing 50mM monomers, 1M $H_3PO_4$ and 0.6M para-toluene sulphonic acid (PTSA), with and without 2M potassium chloride (KCl), by sweeping the potential between −0.2 and +1.0V (vs. Ag/AgCl), at a scan rate 100mV/s and under Oxygen-free nitrogen atmosphere at 25ºC. This paper reports on anodic homo polymerization and copolymerization of Ani and DNP on CG in aqueous medium. Homo and copolymer are characterized by cyclic voltagram , SEM, FT-IR . As a result application of higher ratio of aniline monomer and KCl in electro synthesis cause better copolymerization in $H_3PO_4$.

**Keywords:** polyaniline, conductive polymer, aniline copolymer, 2,4dinitrophenole

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# Study of electrochemical activity of platinum on zinc oxide electrocatalyst for oxygen reduction reaction in presence of Vulcanin reaction layer

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## Abstract

However, a multitude of materials other than Carbon Blacks(CBs) have been investigated as catalyst supports for PEMFCs. Over the last decade or so, the focus has shifted towards nanostructured supports as they enable faster electron transfer and high electrocatalytic activity.The search for non-carbonaceous based supports is particularly essential to deal with the issue of carbon corrosion. In this study ZnO nanostructures was investigated as a substrate for platinum electrocatalyst. Then Vulcan XC-72 addition on electrochemical activity of platinum on ZnO nanostructures electrocatalyst for oxygen reduction reaction(ORR) in PEM fuel cell was studied. ZnO nanoparticles were prepared by a simple solid-state reaction method. For preparation of electrocatalysts combined process of impregnation and seeding methods were used. The effect of adding Vulcan XC-72 to electrocatalyst and the electrode performance for oxygen reduction reaction was evaluated by three electrode systems. The linear sweep voltammetry (LSV), cyclic voltammetry and impedance Spectroscopy was used for oxygen reduction reaction. The performance of prepared electrocatalyst for ORR was improved by adding Vulcan in reaction layer. It can be arisen from the unique nanostructure of the substrate, highly distributed Pt nano particles and high surface area of the support.

**Keywords:**Oxygen reduction reaction; platinum on zinc oxide , non-carbon substrate

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# Electrocatalytic Determination of Glutathione Using Single Wall Carbon Nanotubes Paste Electrode

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## Abstract

Glutathione (GSH) is a tripeptide with a gamma peptide linkage between the amine group of cysteine and the carboxyl group of the glutamate side-chain [1]. It has long been established that the thiol moiety of GSH s important in antioxidant defense, xenobiotic and eicosanoid metabolism, and regulation of the cell cycle and gene expression. Since the first application of carbon nanotubes in the preparation of an electrochemical sensor, an increasing number of publications involving carbon nanotubes-based sensors have been reported, demonstrating that the particular structure of carbon nanotubes and their unique properties make them a very attractive material for the design of electrochemical biosensors [2].

we constructed a new sensor for the rapid, sensitive, and highly selective voltammetric determination of glutathione using single wall carbon nanotubes paste electrode. The objective of this novel electrode modification was to seek new electrochemical performances for the detection of glutathione. The modified electrode showed an excellent electrocatalytic effect on the oxidation of glutathione.

**Keywords:** Glutathione; Modified electrode; Voltammetry; Carbon nanotubes

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Determination of Dopamine in real samples using $PdAL_2O_3$ nanoparticles modified carbon paste electrod

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## Abstract

Dopamine (DA) is an important monoamine neurotransmitter in central nervous system of mammalians. Low levels of DA are related to neurological disorders such as parkinson's disease, schizophrenia and to HIV infection[1]. A carbon paste electrode modified with nanoparticles $pdAL_2O_3$ was prepared for determination of dopamine(DA). Cyclic voltammetry, differential pulse voltammetry (DPV) techniques were used to investigate the modified electrode for the electrocatalytic of DA oxidation in aqueous solutions. Potential of DA at 210mV . The results revealed that the modified electrode shows an electrocatalytic activity toward the anodic oxidation peak of DA by a marked enhancement in the current response buffer solution at PH:6.8. liner analytical curve was absereved in the range of .08 µM to 30 µM [$r^2$:9987]. The detection limits for this method is $6\times 10^{-8}$ M. The chemically modified electrode was successfully used for the quantification of DA in serum sample . Therefore it is essential to develop simple and rapid methods for determination of these biological molecules in routine analysis.

The prepared modified electrode showed several advantages،such as asimple preparation method high sensitivity low detection limits and excellent reproducibility.

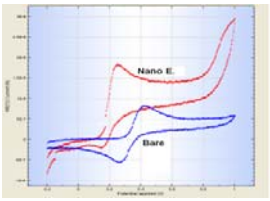


**Figure 1**. Cyclic voltammetry of 40.00 µM dopamin in 0.10 M PB (pH 6.8). Scan rate: 30.0 mV s−1.

**Ke y words:** dopamine. carbon paste electrode. Palladiyum. differential pulse.

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrocatalytic Oxidation of Glycine on Thiourea Modified Copper Electrode in Alkaline Media

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## Abstract

This study investigated the electrocatalytic oxidation of glycine on thiourea electrodeposited on the surface of copper electrode in alkaline solutions. Surface physical characteristics of the modified electrode were studied by scanning electron micrographs (SEM). Results showed a good coverage of thiourea catalyst particles on the surface of copper electrode. The electrocatalytic activity of the modified electrode for the oxidation of glycine, in aqueous basic solution was studied by using cyclic voltammetry. Compared with the unmodified copper electrode, the modified electrode exhibits good catalytic activity for the oxidation of glycine. The catalytic oxidation peak current was linearly dependent on the glycine concentration. The process is diffusion controlled and the current-time responses follow cottrellian behavior. The kinetic parameter such as the electron transfer coefficient (α) and exchange current density ($j_0$) for the modified electrode were calculated.

**Keywords:** Thiourea, Modified copper electrode, Glycine, Cyclic voltammetry

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Influence of Hydrodynamic Conditions on the Corrosion Inhibition of St-37 Rotating Disc Electrode in Simulated Cooling Water Systems by Tartaric Acid (As a Green Inhibitor)

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## Abstract

The corrosion of steel equipment in contact with circulating water is one of the major problems in cooling systems. Application of corrosion inhibitors is one of the preventative methods which has been reported to be helpful in cooling systems. in this work The corrosion inhibition of St-37 rotating disc electrode, RDE, was investigated using tartaric acid as a green corrosion inhibitor in simulated cooling water systems. The inhibiting properties were investigated by open circuit potential measurements, Electrochemical impedance spectroscopy (EIS) and Potentiodynamic polarization techniques. Results showed that by rotating the electrode in inhibited solutions, corrosion current density, $i_{corr}$, increased, corrosion potential, $E_{corr}$, shifted toward more positive values and charge transfer resistance, $R_{ct}$, decreased. The inhibition efficiencies increased with electrode rotation rate due to the enhanced mass transport of inhibitor molecules toward the metal surface and formation of more protective films. However, increasing rotation speed up to 2000 rpm led to a reduction in inhibition performance which was attributed to the effect of mechanical shear stresses on separation of adsorbed protective layers and enhancement of the solubility of tartaric acid complexes with iron ions.

## Keywords

Rotating Disc Electrode, Hydrodynamic Conditions, Green Corrosion Inhibition, Cooling Water System

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Electrochemical Glucose Sensing Based on Nano-Sized Bisphenolic Ag Complex

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## Abstract

In this project, we investigated a new non-enzymatic sensor for the measurement of glucose. The detection of glucose is important, since it is related to diabetes. This sensor was prepared in the basis of Ag complex. The size of complex was characterized below 100 nm by the scanning electron microscopy. The spectroscopic analyses of the complex confirmed the synthesis of the complex. Silver complex was dispersed in ethanol and put on a glassy carbon electrode. The cyclic voltammetry and chronoamperometry were employed as electrochemical methods. The study of cyclic voltammograms in different pH solution was performed. The NaOH solution showed the best results. The potentials were chosen by the increasing effect of the glucose injection on the signals. The glucose injection represented the oxidation potential around 0.55 V versus Ag/AgCl reference electrode. The potential scan rate indicated linear relationship between peak current and the root of scan rate.

**Keywords: Bisphenolic Ag complex; Cyclic voltammetry; Chronoamperometry; Glucose**

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4 , 5 December 2013

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# Electrochemical determination of oxalic acid using Pd doped mesoporous SBA-15 modified carbon paste electrode

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## Abstract

Oxalic acid (OA) widely exists in plants, animals and microbes. Since it can easily combine with $Ca^{2+}$ and $Mg^{2+}$ to form less soluble salts, high levels of OA in the digestive system lead to formation of kidney stones. Therefore, the accurate detection of OA has attracted considerable interest. In this work, palladium was supported on a mesoporous SBA-15 (Pd/SBA-15) by a simple and low-cost method and characterized using X-ray diffraction (XRD), scanning electron microscope (SEM) and energy dispersive X-ray (EDAX). Moreover, carbon paste electrode modified with Pd/SBA-15 (Pd/SBA-15/CPE) was prepared and electrochemical oxidation of OA was studied at Pd/SBA-15/CPE. Pd/SBA-15/CPE exhibited high electrocatalytic performances with fast voltammetric response and decreased overpotential compared to the bare CPE. Based on its high sensitivity, the proposed method was applied to determination of OA in tomato and onion, and the satisfactory results confirmed the applicability of this sensor in practical analysis.

**Keywords: Oxalic acid; Pd dopped SBA-15; Electrocatalysis; Modified electrode**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Modified carbon paste electrode with nano composite of $ZnFe_2O_4$ and $TiO_2$ as a sensor for determination of acetaminophen

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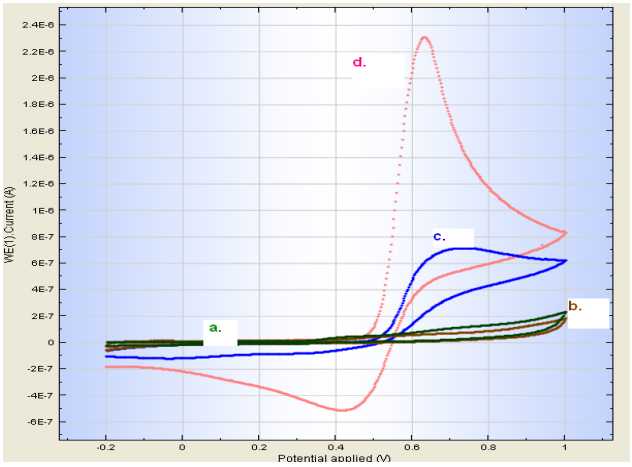
**Abstract**

Acetaminophen(Ac) or paracetamol, a widely used antipyretic and analgesic drug , is an effective and safe agent used world wide for the relief of mild to moderate pain associated with headaches, back aches , arthritis and postoperative pain. It is used for reduction of Feuers of bacterial or viral origin[1]. Nano composite of $znfe_2o_4$ and $Tio_2$ Modified carbon paste electrode has been used for the determination of Acetaminophen (Ac),by cyclic voltammetry (cv) , differential pulse voltammetry (DPV). The results revealed that the modified electrode shows an electro catalytic activity toward the anodic oxidation of Acetaminophen in the current response in buffered solution at (PH: 4.2) and the anodic peak potential shifts by 0.57v when compared with the potential using bare carbon paste electrode. A linear analytical curve was observed in the range of 0.02 µM to 120µM [$r^2$:996]. The detection limit for this method is 0.01µM .The method was then successfully applied to the determination of Acetaminophen in tablets and human urine.

**Keywords:** Acetaminophen, Zn $Fe_2O_4$ and $Tio_2$ Nano composite, Modified carbon paste electrode, voltammetry Methods.




Cyclic voltammograms of (CPE) $Znfe_2O_4/Tio_2$ in 0.1 M phosphate buffer (PH : 4.2)In the absence and (b) in the presence of( 50 µM ) Ac: (c) and (d) for an unmodified carbon paste electrode absence an presence of (50 µM) Ac

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# Investigation of Electrochemical Behaviors of cathodic materials Lithium Iron Phosphate nanoparticles in LIB Batteries

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**Abstract**

In this work, $Li_3Fe_2(PO_4)_3$ nanoparticles was synthesized by sol-gel routh. $LiNO_3$, $Fe(NO_3)_3$ and $(NH_4)H_2PO_4$ were dissolved in ethanol:water solvent, then polyvinyl alcohol (PVA) as gel making agent was added slowly to the mixture salts. Prepration, drying and pyrolysis of gel was performed under flowing gas mixture (10% $H_2$ in $N_2$). Parameters of solvent composition, weight percentages of PVA and salts and combustion temperature were optimized .structural, morphology and particle size were investigated by scanning electron microscopy (SEM), X-ray diffraction (XRD), transmission electron microscopy (TEM), dynamic light scanning (DLS) and BET. The $Li_3Fe_2(PO_4)_3$ synthesized nanoparticles in optimum conditions was used as electroactive material in voltametery. To make electrod the prepared $Li_3Fe_2(PO_4)_3$ powders were mixed well together with acetylene black and Teflon (PTFE) in ratio 80:10: 10 in N-methyl pyrrolidinone (NMP) to form a slurry (as electrode material was used in battery tests, too). The slurry was spread uniformly on a thin aluminum foil with a diameter of 1mm and then were vacuum dried at 120°C for 2h. as electrolyte a 1M LiPF6 solution in 1:1 volume ratio of ethylene carbonate (EC) and dimethyle carbonate (DMC) mixed solvent was applied. cycle voltameteric behaviors of the prepared electrodes were investigated in the potential window of 2-4V versus two lithium plats as counter and reference electrodes, in Ar atmosphere. The results of voltammograms indicated good reversibility in electrochemical behaviors of $Li_3Fe_2(PO_4)_3$ synthesized nanoparticles. To conform discharged tests and the life test, was loaded with made cathode material cathodic hole of batteries the screwed batteries were charged with constant current equal theoretical capacity (128.2 $mAhg^{-1}$) for 1h then, the fully charged batteries were discharged by the same constant current to decrease the battery voltage to 2.3V. In the cycle life test, the charge process was done by constant for 1h, likely discharge test and then, the battery was kept in rest for 1 min. Finally, the battery was discharged by constant current to cut off voltage of 2.3V. A charge, a rest and a consecutive discharge step was regarded as one cycle life. The three step cycle was repeated for 75 times. The CV results are confirmed by the battery tests. The obtained results show that the synthesized cathodic materials has high practical discharge capacity (average 125.5 $mAhg^{-1}$ approximately same with its theoretical capacity 128.2 $mAhg^{-1}$) and long life.

**Keywords:** $Li_3Fe_2(PO_4)_3$; nanoparticles; voltammetry; charge-discharge; cathodic materials; LIB

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# ZnO/CNTs nanocomposite as a sensor and a catechol derivative as a mediator for determination of captopril in pharmaceutical and biological samples

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## Abstract

A new catechol-derivative compound was synthesized and used to construct a modified-ZnO/CNTs carbon paste electrode. The electro-oxidation of captopril at the surface of the modified electrode was studied using cyclic voltammetry, chronoamperometry, and electrochemical impedance spectroscopy. Under the optimized conditions, the differential pulse voltammetric peak current of captopril increased linearly with captopril concentration. The detection limit was 5.0 nM captopril. The diffusion coefficient and kinetic parameters (such as electron transfer coefficient and the heterogeneous rate constant) for captopril oxidation were also determined. The RSD% for 0.2 and 15.0 µM captopril were 2.2% and 1.9%, respectively. The proposed sensor was successfully applied for the determination of captopril in human patient urine and tablet samples.

**Keywords:** ZnO/CNTs nanocomposite; Captopril; Sensor.

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A novel nanocomposite carbon paste electrode for voltammetric determination of hydrazine

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## Abstract

The application of a novel mediator, as a sensitive and selective voltammetric sensor for the determination of hydrazine using square wave voltammetric method were described. The modified ZnO/CNTs paste electrode exhibited a good electrocatalytic activity for the oxidation of hydrazine at pH = 6.0. The catalytic oxidation peak currents showed a detection limit (S/N = 3) 0.008 µmol/L of hydrazine. The relative standard deviations for 0.5 and 10.0 µmol/L hydrazine were 1.2 and 1.5%, respectively. The modified electrode showed good sensitivity and selectivity. The diffusion coefficient (D) and the kinetic parameters such as the electron transfer coefficient (α) of hydrazine at the surface of the modified electrode were determined using electrochemical approaches. The electrode was successfully applied for the determination of hydrazine in real samples with satisfactory results.

**Keywords:** ZnO/CNTs nanocomposite; Hydrazine; Carbon paste electrode.

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4 , 5 December 2013

University of TarbiatModares,Tehran, Iran

# Voltammetric Determination of Dichromate Using Carbon-Past Electrode Containing Clinoptilolite nanoprticles Modified with surfactant

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## Abstract

Carbon-paste electrodes containing clinoptilolite nanoparticles modified with hexadecyltrimethylammonium bromide (HDTMA-Br) surfactant (Nclino-SMZ) were used to study the cyclic voltammetric determination of dichromate. The electrode containing 10% SMZ exhibited linear response range to dichromate species in the range of 1 $00\times10^{-7}$ to $1.00\times 10^{-2}$ M with a detection limit of $3.89\times10^{-9}$ M dichromate concentration. The effect of key operating parameters such as: pH, potential scan rate, kind and concentration of supporting electrolyte were investigated. Some cations such as: $Fe^{3+}$, $Ni^{2+}$, $Cr^{3+}$, $Mn^{2+}$ and $Cu^{2+}$ have interference, based on the results, all cations except $Cr^{3+}$ have a litter interference the electrode respons. The method was applied to the determination of chromium(VI) in real sample.such as: Zayanderud water, well water and industrial wastewater of Haftometir company and satisfactory results were obtained.

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**Keywords:** Chromium(VI), Cyclic voltammetric, Clinoptilolite, Nanoparticles

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9th Iranian Annual Seminar of Electrochemistry

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# Surface decoration of multi-walled carbon nanotubes modified carbon paste electrode with gold nanoparticles for sensitive determination of methadone in biological samples

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## Abstract

In this paper, gold nano particles and multi-walled carbon nanotubes were used to fabricate a highly sensitive and selective voltammetric sensor for the determination of methadone. We described a fastand easy method for the fabrication of gold nanoparticles/multi walled carbon nanotube/carbon paste electrode (GNPs/MWCPE) by one-step electrodeposition under controlled potential, the whole procedure takes only several minutes. Scanning electron microscopy (SEM) image demonstrated that the gold nanoparticles deposited on MWCNTs/CPE were uniform, with an average size of 30 nm. By combining the benefits of GNPs/MWCNTs and CPE, the resulted modified electrode exhibited outstanding electrocatalytic activity in terms of methadone oxidation by giving much higher peak currents than those found for the unmodified CPE and also the MWCNTs-modified electrode. The effect of various experimental parameters on the voltammetric response of methadone was investigated. At the optimum conditions the sensor has a linear response in the 0.1–700.0 μmol $L^{-1}$concentration range and a low detection limit of 0.03 μmol $L^{-1}$of methadone. The proposed chemically modified electrode was used to the determination of methadone in in urine and pharmaceutical samples.

**Keywords:** Gold nanoparticles, Methadone, Electrodeposition, Chemically modified electrode

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# Carbon paste ion selective electrode based on 15-benzo crown-5 and carbon nanotubes for determination of silver

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## Abstract

A carbon paste ion selective electrode based on benzo15-crown-5 as an ionophore is proposed for determination of silver in real samples. Important factors such as the amounts of benzo15-crown-5, carbon nanotube as modifier, paraffin as binder and sodium tetraphenylborate (NaTPB) as an additive have been optimized. Under the optimized working conditions: 62.95% (w/w) of graphite powder, 1.80% (w/w) of ionphore, 30.57% (w/w) of paraffin, 30.60% (w/w) of carbon nanotube and 1.08% (w/w) of NaTPB, a nernestian response with a slope of 59.43 (mv) over the concentration range of $10^{-2}$ M to $10^{-5}$ M was obtained. The limit of detection was calculated to be $10^{-5}$ M. The electrode can be used in the pH range of 2-5 and was employed for potentiometric titration of silver with KSCN. The influence of interfering ions was also investigated and the selectivity factors were determined. The proposed electrod was applied for determination of silver in radiographic films.

**Keywords:** Carbon paste; Ion selective electrode; Benzo 15-crown-5; Carbon nanotubes; Silver ion.

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4 ,5 December 2013

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# polymer/Zn nanocomposite as electrodes in supercapacitors

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## Abstract

Supercapacitors or electrochemical capacitors (ECs) are used as a new kind of energy storage devices. Although, metals are usually used in ECs as electrodes, but recently composite materials are known as a capable electrode in ECs. In this research polymer/Zn nanocomposite is synthesized by free radical polymerization in aqueous solution. The characterization of the structures of metal nanocomposites were eraluated by FT-IR , X-ray diffraction (XRD) , scanning electron microscopy (SEM) and , cyclic Voltametry methods. The electrochemical characterization is conducted in an electrolytic solution $Na_2SO_4$. The capacitance of the polymer/Zn composite is associated mainly with the reduction /oxidation of Zn. The composite of Zn has favorable electrochemical behavior. So these composite is suitable material for use as electrode in ECs.

**Keywords:** polymer; nanocoposite; supercapacitor

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4 , 5 December 2013

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# Novel nano-composite modified carbon paste sensor for determination of lead (II) in hazardous wastes

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## Abstract

It is well-known that environmental contamination by heavy metal ions has been a serious and complex problem and has remained a focus of attention all over the world which is harmful to life [1]. Therefore, it is desired to develop the simple, selective, efficient and eco-friendly methods for the determination of these pollutants in environmental and biological samples. Electrochemical sensors have been widely used to detect various substances due to the ease of their construction, easy renewability of the surface and compatibility with various types of modifiers [2]. Herein, we synthesized a composite made of a Schiff base immobilized on magnetic silica coated nanoparticles, as modified core/shell nano-structure, for preparing nano-composite modified IL/MWCNTs paste electrode for the potentiometric detection of $Pb^{2+}$ with wide linear dynamic range of $2.50\times10^{-9}$ – $1.00\times10^{-1}$ M. The surface morphology and electrical properties of suggested electrode were characterized by scanning electron microscopy and electrochemical impedance spectroscopy.

**Keywords: Modified carbon paste electrodes; Magnetic core/shell nano structure**

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# Voltammetric determination of amlodipine besylate at surface of glassy carbon electrode modified using sulfonate carbon nanoparticles

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## Abstract

Amlodipine besylate (AM) is a dihydropyridine derivative with calcium antagonist activity.It is used mainly as an antihypertensive and antianginal Agent. A sensitive and selective electrochemical sensor was fabricated via the drop-casting of sulfonate carbon nanoparticles (4-18nm) suspension onto a glass carbon electode (GCE). The application of this sensor was investigated for determination of AM. In order to study the electrochemical behavior of AM, cyclic voltammograms was recorded at the surfaces of the modified GCE (MGCE) and the bare GCE. The dependence of the potential scan rate and pH were on peak curren and potential investigated. The results exhibites CNPs via a thin layer model based on the diffusion within a porous layer, enhanced the electroactive surface area and caused a remarkable increase in the peak currents. In addition it can show catalytic effect and accelerate the rate of the electron transfer process. Presented good sensitivity and a considerable decrease in the anodic overpotential, leading to negative shifts in peak potentials. An optimum electrochemical response was obtained for the sensor in the buffered solution of pH 7.0 and using 6μL CNPs suspension. Differential pulse voltametry has been used for qunantitative determination of AM. A dynamic linear range of 1.0 × 10−8 to 1.0 × 10− 3 mol L− 1 was obtained the presented sensor has been applied for determination of AM in commerecial tablet.

**Keywords:** 1) Voltammetry 2) Amlodipine 3) Sulfonate carbon nanoparticle 4) Electrochemical sensor

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Determination of epinephrine in the presence of uric acid and folic acid using nanostructure-based electrochemical sensor

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## Abstract

Electrode surface modification is a field of paramount importance in the modern electrochemistry especially due to the various application possibilities of modified electrodes [1]. Carbon nanotubes (CNTs) are one of the most important nanomaterials due to their high chemical stability, high surface area, high mechanical properties, unique electrical conductivity, metallic structural characteristics, and mechanical strength and elasticity. Carbon nanotubes based electrodes are currently in widespread use in electroanalytical chemistry [2].

In this study, a carbon paste electrode modified with carbon nanotubes was used to prepare a novel electrochemical sensor for the detection of epinephrine in the presence of uric acid and folic acid. The response of catalytic current with epinephrine concentration showed a linear relation in the range from $1.0\times10^{-7}$ to $7.5\times10^{-4}$ M with a detection limit of 70.0 nM.

**Keywords:** Epinephrine; Uric Acid; Folic Acid; Electrocatalysis

**References:**

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Determination of ascorbic acid in food samples using NiO Nanoparticle modified carbon paste elecrode

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**Abstract**

Production of NiO nanoparticles (NiO/NPs) by chemical precipitation is the approach utilized in this work. Nanopowders properties are identified by TG, FTIR, XRD, SEM, and TEM. The results obtained confirm the presence of nickel oxide nanopowders produced during chemical precipitation. In continuous, a novel NiO/NPs carbon paste electrode (NiO/NPs/CPE) had been fabricated. Electrochemical behavior of vitamin C at the NiO/NPs /CPE had been investigated in pH 7.0 phosphate buffer solution (PBS) by cyclic voltammetry (CV), chronoamperometry (CA) and differential pulse voltammetry (DPV). The experimental results suggested that the modified electrode exhibited an electrocatalytic activity toward the redox of vitamin C. Detection limit of vitamin C was found to be 0.05 µM. The proposed sensor was successfully applied for the determination of vitamin C in food samples.

**Keywords:** Vitamin C, NiO nanoparticle; Sensor; Modified electrode

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1- M.S. student

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Simultaneous Voltammetric Determination of Codeine (CO) and Acetaminophen (AC) Using a Carbon Paste Electrode Modified with MgO Nanoparticle

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## Abstract

Codeine (CO) has long been used as an effective analgesic and antitussive agent in pharmaceutical preparations . Acetaminophen (AC) is commonly used for relieving mild to moderate pain associated with headache, backache, arthritis and postoperative pain, and is used universally for reducing fevers of bacterial or viral origin. Determination of AC and CO in mixtures, is an important aspect of quality control in pharmaceutical formulations and biological fluids. In this study a method for the simultaneous determination of AC and CO in pharmaceutical formulations using square wave voltammetry was developed. Two very well-resolved and reproducible oxidation peaks of AC and CO were obtained in Britton–Robinson buffer using carbon paste electrode (CPE) modified with MgO nanoparticles. The morphology of the MgO/CPE electrode were characterised by Scanning Electron Microscopy (SEM). The prepared electrode was successfully applied for the determination of AC and CO in real sample.

**Keywords: Codeine; Acetaminophen; Carbon Paste Electrode; MgO Nanoparticle**

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Voltammetric Measurements of Cesium ions Using Carbon paste Electrode Modified with clinopitilolite nanoparticles containing HDTMA and Arsenazo (III)

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**Abstract**

A novel zeolite modified electrode for use in voltammetric determination of Cesium was described. The electrode comprises hexadecyltrimethylammonium bromide surfactant (HDTMA), Arsenazo (III), and nano clinoptilolite particles as modifier in carbon paste matrix. One pair of semi-reversible electrochemical extra peak was observed for the Arsenazo (III) which its peak current was decreased in the presence of cesium. This decrease in the peak current was used fro the determination of cesium in solution. The results demonstrated that diffusion can control of the cesium cations at the surface of the modified electrode. Neutral pH conditions with respect to the acidic one cause an increase in the electrode response. The modified electrode showed a suitable linear calibration graph in the concentration range of $1.0 \times 10^{-8}$ –$1.0 \times 10^{-3}$ mol $L^{-1}$ cesium with a detection limit of $9.6\times 10^{-9}$ mol $L^{-1}$. The influence of potential interfering substances on the peak current was studied and the results showed that the method was highly selective for determination of cesium. Thus, the proposed electrode was used for the determination of cesium in Zayandeh Rood water and the satisfactory results were obtained.

**Keywords**

**Carbon paste electrode, Cesium, HDTMABr, Nano-clinoptilolite, Arsenazo (III), Surfactant, Zeolite**

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Determination of EPinephrin by nano composite $ZnFe_2O_4$ and $TiO_2$ Modified carbon paste electrode

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## Abestract

EPinephrin(EP) is an important neuro trans mitters in mammalian central nervous systems(1),and it exits in the nervous tissue and body fluid in the form of large organic cations . The change of its concentration may result in many diseases(2) . There are some methods applied for the determination of EP . As an electroactive device, it can also be studied viaelectrochemical technique. Some reports showed the electrochemical response of EP on different kinds of electrodes .Nano composite $ZeFe_2O_4/TiO_2$ modified carbon paste electrode has been used for the determination of EPinephrin (EP) by cyclic voltammetry(CV). Differential pulse voltammetry (DPV). Basied on the anodic oxidation peak at ( 0.6 v)in $H_3PO_4$(0.1M) buffer at (PH: 7) . A linear an analytical curve was abserved in the range of 0.08 µ M to260µ M ($r^2$:0.998). The determination limit for this method is 0.07 µ M.

WE examined this method for the voltammetric determination of EP in injection samples.

**Key word :**EPinephrin,Nano composite modified carbon paste electrode,voltammetry methodes

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Determination of EPinephrin by nano composite $ZnFe_2O_4$ and $TiO_2$ Modified carbon paste electrode

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## Abestract

EPinephrin(EP) is an important neuro trans mitters in mammalian central nervous systems(1),and it exits in the nervous tissue and body fluid in the form of large organic cations . The change of its concentration may result in many diseases(2) . There are some methods applied for the determination of EP . As an electroactive device, it can also be studied viaelectrochemical technique. Some reports showed the electrochemical response of EP on different kinds of electrodes .Nano composite $ZeFe_2O_4/TiO_2$ modified carbon paste electrode has been used for the determination of EPinephrin (EP) by cyclic voltammetry(CV). Differential pulse voltammetry (DPV). Basied on the anodic oxidation peak at ( 0.6 v)in $H_3PO_4$(0.1M) buffer at (PH: 7) . A linear an analytical curve was abserved in the range of 0.08 µ M to260µ M ($r^2$:0.998). The determination limit for this method is 0.07 µ M.

WE examined this method for the voltammetric determination of EP in injection samples.

**Key word :**EPinephrin,Nano composite modified carbon paste electrode,voltammetry methodes

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3.H.Beitollahi,M.Mazloum Ardakani, B .Ganjipour ,H.Naeimi, Biosens. Bioelectron. 24(2008)362.

**9th Iranian Annual Seminar of Electrochemistry**
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# Electrochemical Impedance Spectroscopy of Modified Graphite Electrode by Polyaniline in Presence of Cr and Cu

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## Abstract

Polyaniline is one of the most important conductive polymers that its structural studies started at 1980 just because of its great electrical conductivity and stabilities in open air [1,2]. In this project we used impedance spectroscopy techniques to determine the conductivity and charge transfer resistance properties of polyaniline film in aqueous solution that contains Cr and Cu. we also discussed its nyquist curves at 0.8 voltage.
From the achieved results it has been expected that the charge transfer resistance of Cu Shall be reduced because of full filled 3d layer and increasing of shielding effects[3]. so the charge transfer resistance of Cu is less than Cr and its charge transferring is much higher than Cr. these properties leads to the easier redox transfers of an conductive polymer.

### Keyword

Cr, Cu, Polyaniline, Impedance

### Refrence

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Voltammetric determination of paracetamol using carbon paste electrode modified with Cu(II)-ion exchanged clinoptilolite nanoparticles

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## Abstract

In this research, carbon paste electrode was modified with Cu(II)-ion exchanged clinoptilolite nanoparticles and used for the determination of paracetamol (PAR). First microparticels of clinoptilolite was converted to nanoparticles by mechanical ball-mill method. Clinoptilolite nanoparticles were ionexchanged in 0.5M Cu(II) aqueous solution and the Cu(II)-exchanged sample was mixed with graphite powder and nujol oil to obtain modified carbon past electrode (Nclino-Cu(II)/CPE). Samples characterized with BET, BJH,XRD and TEM methods. The measurements were carried out by application of the cyclic voltammetry, square wave voltammetry and chronoamperometry methods. The effects of several parameters such as pH, particle size of zeolite, kind and concentration of supporting electrolyte and potential scan rate were investigated. The cyclic and square wave voltammetric, and also chronoamperometry response of the electrode to paracetamol were linear in the rangeof$1.0 \times10^{-9}$_ $1.0 \times10^{-3}$ M,$1.0 \times10^{-11}$_ $1.0 \times10^{-2}$ M, $1.0 \times10^{-12}$_ $1.0 \times10^{-2}$M, with a detection limit of $3.3\times10^{-10}$ M, $3.5\times10^{-12}$ M, $1.2\times10^{-12}$ M, respectively. The interfering effect of several cationic species and organic compounds was investigated and tolerance limits were obtained. The proposed method was successfully used to determine paracetamol in the reliefen capsule, acetaminophen pills and adult could pills.Typical features of the method can be summarized as: low cost, simple preparation, fast response, good stability and selectivity and high reproducibility.

**Keywords:**Paracetamol, Voltammetric, Clinoptilolite, Nanoparticles

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**9th Iranian Annual Seminar of Electrochemistry**

4 , 5 December 2013
University of Tarbiat Modares, Tehran, Iran

# Electrocatalitical Effects of Homo, 2-4 dinitrophenol and Aniline Copolymer Modified Electrode in Cr Solution

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## Abstract

In general ,we can mention that every electrodes that its surface molecular structure can response better either to chemical or physical electro analyzing, are in the group of modified electrods [1-3]. in this project we study the electrocatalitical effects of modified electrod by homo, 2-4 dinitrophenol and aniline copolymer.
We there is a preference to the potential shift we use the aniline homopolymer and when there is a preference to the current shift we use aniline homopolymer 2-4 dinitrophenol. and when we want both current and potential shifts simultaneously we use the synthesized copolymer because of its interfacial behavior.

**Keyword**

Cr, 2-4 dinitrophenol, Aniline, Electrocatalitical Effects

**Refrence**

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# Immobilization of glucose oxidase onto modified$Tio_2$ nanoparticles: direct electron transfer and electrocatalytic activity.

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## Abstract

We provide a new organic–iorganicnanocomposite for enzyme immobilization.The composite consisting of modified TiO2 with 2,2'-dithioxo-3,3'-bis(3-(triethoxysilyl)propyl)-2H,2'H-[5,5'-bithiazolylidene]-4,4'(3H,3'H)-dione(DTP)and graphene.DTP as covalently attached to the ofsurfaceTiO2 nanoparticles and employed for obtaining a suitable solid surface to enzyme attachment.In this work glucose oxidase (GOx) was irreversibly immobilized on the titanium oxide nanoparticle (TiO2/ DTP) using consecutive cyclic voltammetry.The enzyme immobilization and the enzymatic activity were determined by UV/vis Spectroscopy and Electrochemical method.The results implied to significant rule of DTP on the enzyme immobilization.Direct electrochemistry and electrocatalytic activity of modifiedelectrode were evaluated by voltammetric techniques.The cyclic voltammogram displayed a pair of well-defined and nearly symmetric redox peaks with a formal potential of-460mV and an apparent electron transfer rate constant of 5.8 s-1. The GOx/TiO2-DTP can catalyze the electroreduction and electrooxidation of hydrogen peroxide formed from enzymeatic oxidation of glucose.The modified electrode shows excellent activity toward direct oxidation of glucose in presence of ferocene methanol as an artificial redox mediator.The glucose biosensor shows fast amperometric response (3s) with good stability, linear calibration range, high sensitivity and low detection limit.

**Keywords**
$tio_2$,electrocatalysis, Glucose oxidase, Glucose, Biosensors, Electrochemical sensors, Electrochemistry

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical Impedance Spectroscopy of Modified Graphite Electrode by Polypyrrole in Presence of Cr and Cu

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## Abstract

Today, pyrrole is chemically polymerized in conductive state since the polymer is oxidized by a doping agent which is an oxidizing salt. Ferric salts are commonly used in chemical synthesis of conductive polymers [1-3].
In this project we used impedance spectroscopy techniques to determine the conductivity and charge transfer resistance properties of Polypyrrole film in aqueous solution that contains Cr and Cu .we also discussed its nyquist curves at 0.8 voltage. From the achieved results it has been expected that the charge transfer resistance of Cu Shall be reduced because of full filled 3d layer and increasing of shielding effects[4]. so the charge transfer resistance of Cu is less than Cr and its charge transferring is much higher than Cr. these properties leads to the easier redox transfers of an conductive polymer.

### Keyword

Cu, Cr, Polypyrrole, Impedance

### Refrence

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013
University of Tarbiat Modares, Tehran, Iran

# Electrocatalytical Effects Studies of Modified Electrode by Pyrrole and Potassium Chloride as Support in Cr Solution

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## Abstract

Conductive Polymers are materials that have electrical properties of metals in parallel with astonishing properties of polymers. The most common and general of these kinds of polymers we can mention to the poly pyrrole that is very attractive because of its atmospheric stability, easy synthesis and high conductivity [1-3].
Deferential pulse voltammetry is one of the most sensitive methods for determining the small amounts of inorganics and organics materials. in this project we study the electrocatalytical effects of modified electrode by poly pyrrole.
Observing the electrocatalitical effects synthesized polymer concluded to the negative potential shifts and positive shifts of current on voltagram compared with the unmodified electrode voltagram. this proves the existence of modified electrode electrocatalytical effects in Cr solution.

### Keyword

Cr, Pyrrole, Deferential pulse voltammetry

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrodeposition of Nickel oxide nanowires: Application for electrocatalytic determination of $S_2O_8^{-2}$

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## Abstract

The first step of paper nickel nanowires was fabricated by DC electrodeposition method in Anodic aluminum oxide templates. For fabrication high quality nanowires with arbitrary diameter and uniform length , the optimal conditions of electrodeposition (pH, voltage, electrolyte concentration) and nanowires growth rate were calculated. To achieve high porosity and pseudo-brushes surface of nanowires, optimal conditions for removing of template such as etchant concentration and etching rate were investigated by using of SEM and AFM images of surface topography. The next step was the use of the high porosity, specific surface area of nickel nanowires to immobilize neutral red on carbon paste electrode surface. Modified carbon paste electrode with nickel nanostructures and neutral red were investigated by electrochemical techniques. Various parameter such as electron transfer rate constant, charge transfer coefficient, surface coverage concentration and effective surface area of the electrode were calculated. Finally the modified electrode used for fabrication of sensitive persulfate electrochemical sensor. Result shown the modified electrode has good ability for persulfate detection in standard and real samples.

### Keywords

Metallic nanowires; electrodeposition template; etching; electrochemical techniques

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Potentiometric sensor based on molecularly imprinting polymer for determination of Diclopenace in biological fluids

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## Abstract

A new ion selective electrode based on potentiometric method was developed for the determination of Diclopenace. The membrane electrode was modificated with molecularly imprinting polymer in order to improve the electrochemical behaviour of proposed membrane electrode [1-2]. The sensor shows stable and linear response with a slope of -56.2 mV decade$^{-1}$ in the pH ranges from 7 to 8 for the Diclopenace concentration in the range of 1.0 ×10$^{-5}$ to 1.0 ×10$^{-2}$ mol L$^{-1}$ and with a detection limit of 4.0 ×10$^{-6}$ mol L$^{-1}$ of Diclopenace. Additionally, the interference between Diclopenace and several drugs and common inorganic ions was negligible as shown by the potentiometric selectivity coefficient data. The electrode shows easy construction, low cost, fast response (20 sec) and can be used for a period of 1 month without significant change in its performance characteristics. The membrane sensor was successfully applied to the determination of Diclopenace in biological fluids.

**Keywords: Potetiometry; molecularly imprinting polymer; Diclopenace**

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# Electrocatalytic Oxidation of Formic Acid on a Nanoporous Co/Co-Ni-Ag Electrode in Alkaline Media

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## Abstract

An electrochemical approach to nanostructured Co/Co-Ni-Ag catalyst with high activity design using the electrodeposition process and galvanic replacement technique is presented [1]. The procedure consisted of the electrodeposition of Co-Ni-Zn on the Co coating, with subsequent replacement of the Zinc by Siver at open circuit in a Siver containing alkaline solution [2]. The surface morphologies and compositions of coatings were determined by energy dispersive X-ray and scanning electron microscopy techniques. The characterization showed that the leached Co/Co-Ni-Ag coating has a nanoporous structure [3]. The electrocataiytical oxidation of formic acid on Co-Ni-Ag electrode was studied using CV, choronoamperometery and electrochemical impedance spectroscopy. The anodic peak current density was found to be up to ten times higher on Co/Co-Ni-Ag electrode for formic acid compared to that flat Ag. These results indicate that the system studied in the present work is the most promising system for use direct formic acid fuel cells [4].

**Keywords:** Formic Acid; Nanoporous; Co/Co-Ni-Ag; Alkaline Media

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4 , 5 December 2013

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# A Novel Aptasensor based on MWCNT-Chitosan nanocomposite for electrochemical sensing of Codeine

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**Abstract**

Codeine is among naturally occurring alkaloids in opioid plants, has long been used as a drug, and is also abused. Thus, developing a selective, specific and straightforward method to detect codeine is highly demanded in various fields. In this work, we have fabricated a novel electrochemical biosensor based on covalent immobilization of a DNA aptamer onto the multiwalled carbon nanotubes/chitosan nanocomposite (MWCNT/Chit) for electrochemical determination of Codeine. The applied redox mediator has been wired on the electrode surface. Upon codeine addition, a complex was formed between the DNA aptamer and codeine which led to decrease in the current of wired electrochemical redox indicator. The decrease in current was linear with codeine concentration. Furthermore, the proposed aptasensor was able to selectively detect codeine in the presence of different interfering compounds. Finally, this aptasensor was successfully used to detect codeine in real samples.

**Keywords**: Aptasensor, Codeine, nanocomposite, Biosensor, wired electrochemical redox indicator, multiwalled carbon nanotubes

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Structural Effect on Nucleophilic Addition of Aniline Derivatives to Noradrenaline

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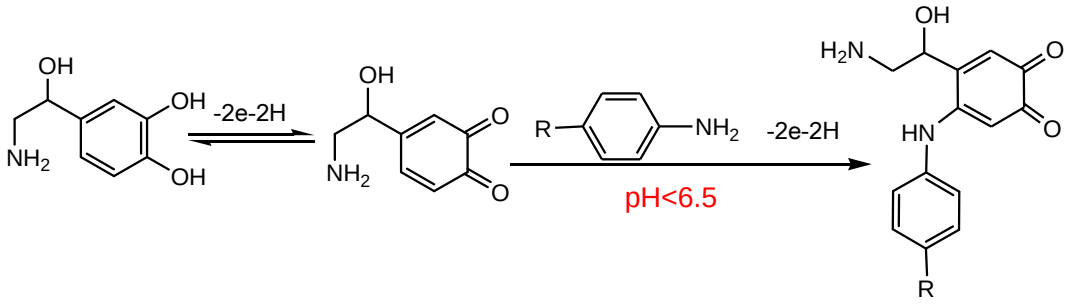
## Abstract

Electrochemical oxidation of noradrenaline has been studied in the presence of various aromatic amines with electron donating and withdrawing substituent. Some electrochemical techniques such as cyclic voltammetry and its diagnostic criteria for various electrode reactions were used. The competition between intramolecular and intermolecular Michael addition reaction were studied at various pH values, various aniline derivatives (aniline, N-methylaniline, 4-boromoaniline, and 3-nitroaniline).




The results show that despite of presence of amine group on noradrenaline and possibility of intramolecular Michael addition, the nucleophilic addition of aromatic amines are the dominant reaction at mild acidic conditions.[1] This is related to lower basicity of aniline derivative and their deprotonation at mild acidic conditions. The amines with electron withdrawing character has less reactivity and rate constant, but they shows a good reactivity at more acidic conditions considering their less basicity. Also the scheme for the electrochemical oxidation of noradrenaline in the presence of aniline derivatives is proposed and tested by digital simulation. Based on an ECE mechanism, the observed homogeneous rate constants ($k_{obs}$) of Michael addition reaction have been estimated by comparison of the simulation results with experimental cyclic voltammograms at various pHs.[2] The simulated cyclic voltammograms show good agreement with those obtained experimentally.

**Keywords:** noradrenaline; electrochemical derivatization; digital simulation

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4 , 5 December 2013

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# Ivenstigation of Electrochemical Behavior of Nitrite Ion at the Surface of Different Electrodes

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## Abstract :

The occurrence of nitrite salts in the environment and their use for food preservation is widespread, numerous studies have shown that nitrite is hazardous to human health because it can be converted into carcinogenic nitrosoamines under the acidic conditions of the stomach Moreover, nitrite in the bloodstream can cause the irreversible oxidation of hemogloblin to methemoglobin, with the consequent removal of oxygen. This conversion can induce “blue body” syndrome due to a lack of oxygen inside the body it is used to inhibit corrosion in industrial water. Also, nitrite is an important source of nitrogen in green plants and its complete reduction is achieved in nature by nitrite reduction enzymes. therefore it is important that sensitive and accurate methods be available for the determination of nitrite ion. Numerous papers have been published on the determination of nitrite [1, 2]. In the present study, elctrocatalytic oxidation of nitrite in pH 7 phosphate buffer solution at the surface of different electrode. Using cyclic voltammetry, a large catalytic current is observed upon oxidation of nitrite in phosphate buffer (pH 7) at the surface of different electrode to the current obtained unmodified electrode with no nitrite present. Finally, the rate constant of the oxidation of from the nitrite in phosphate buffer was determined by cyclic voltammetry experiments. Kinetic parameters such as electron transfer coefficient (α) and charge transfer rate constant (k) for the oxidation of nitrite using cyclic voltammetry (CV) was determined.

**Keywords:** Nitrite, Different Electrodes, Cyclic Voltammetry (CV)

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4 , 5 December 2013

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# Nickel(II) selective membrane potentiometric sensor using dimethylglyoxime- clinoptilolite nanoparticles as an ionophore

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## Abstract

Potentiometric electrodes based on the incorporation of nano clinoptilolite (NCP) particles and dimethylglyoxime (DMG) into poly vinyl chloride (PVC) membranes were described. These electrodes were highly selective to Ni(II) ions. The influence of membrane composition on the electrode response was studied. The best performance was observed with the membrane having 10% NCP-DMG, 30% PVC, 60% dioctyl phthalate (DOP) and 1.5 mL tetrahydrofuran (THF) and it worked well in a wide concentration range of $1\times10^{-5}$-$1\times10^{-1}$ M with a Nernstian slope of $29.3 \pm 0.3$ mV per decade of activity between pH 4.5-8. It has a response time of $\leq 10$ s and can be used at least 2 months without any measurable divergence in potential. The membrane reveals good selectivity for nickel ions over the other metal ions investigated. This modified electrode was successfully applied to the direct determination and potentiometric titration of nickel ion with EDTA.

**Keywords:** *Ion selective membrane electrode, Clinoptilolite, Nickel, PVC membrane*

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4 , 5 December 2013

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# Ivenstigation of Electrochemical Behavior of Nitrite Ion at the Surface of Different Electrodes

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## Abstract

Nitrite ($NO_2^-$), as a typical inorganic pollutant, has caused serious hazards to public health and the environment, and its anthropogenic sources are wastes from fertilizers [1]. Nitrite promotes the irreversible oxidization of hemoglobin to meet hemoglobin and reduces the blood capacity to transport oxygen [2]. In addition, it can react with amines to form N-nitrosamines, many of which are known to be carcinogens [3]. In the present study, electrocatalytic oxidation of nitrite in pH 7 phosphate buffer solution at the surface of different electrode was investigated. Using cyclic voltammetry, a large catalytic current is observed upon oxidation of nitrite in phosphate buffer (pH 7) at the surface of different electrodes such as Au, Pt and GC . The rate constant of the oxidation of from the nitrite in phosphate buffer was determined by cyclic voltammetry experiments. Kinetic parameters such as electron transfer coefficient (α) and charge transfer rate constant (k) for the oxidation of nitrite using cyclic voltammetry (CV) and the diffusion coefficient (D) using chronoamprometre was determined.

**Keywords:** Nitrite, Different Electrodes, Cyclic Voltammetry (CV)

## References

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4 , 5 December 2013
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# Application of Metal–organic frameworks (MOFs) as catalysts for electrochemical hydrogen production

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## Abstract:

Hydrogen is becoming more important as an energy source for fuel cells, so it is essential to develop active and efficient catalysts for $H_2$ production. There are several methods for hydrogen production, which electrolysis is one of these methods. One important challenge in the electrochemical hydrogen production is reducing loaded Pt, common efficient but very expensive catalyst, or replace other materials in the hydrogen evolution reaction.

In this study CuBTC Metal–organic framework (MOF) was synthesized and carbon paste electrode was modified by this catalyst for hydrogen evolution reaction (HER). According to our knowledge, this is the first report which apply MOFs for efficient electrochemical hydrogen production. For optimization of conditions some parameters including catalyst percent, paste binder amount and pH was changed and their effect on HER was evaluated. The best performance was obtained for MOF modified CPE (30% catalyst, 15% binder) in 2 M $H_2SO_4$ solution. In addition, a promising result showed that by applying successive CVs the overvoltage reduces.

**Keywords:** Carbon paste electrode (CPE), Electrochemical Hydrogen production, Metal–organic frameworks (MOFs)

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# CdS/$TiO_2$/Graphene Nanocomposite Photoanode for Enhanced Photoelectrochemical Performance

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## Abstract

Hydrogen is one of candidates for replacing fossil fuels that can be produced from water splitting via photoelectrochemical (PEC) process using solar energy. Also, Graphene with high conductivity, electron mobility, chemical stability and specific surface area is very attractive for PEC applications. In this research, several systems including $TiO_2$, CdS, CdS/$TiO_2$, CdS/Graphene, $TiO_2$/Graphene, CdS/$TiO_2$/Graphene are synthesized by sol-gel and successive ion layer adsorption and reaction (SILAR) process. SEM, EDX and XPS are employed to characterize the corresponding systems. Photocurrent density generated in the process is used as a measure for comparing their PEC performance. Based on our data analysis, the CdS/$TiO_2$/Graphene photoanode achieved about 4 A/$m^2$ that is higher than the synthesized single and binary nanocomposite photoanodes. High specific surface area of Graphene as well as the multistep electron transfer mechanism is believed to be responsible for this enhancement.

**Keywords**
Graphene based nanocomposite, PEC performance, Electron transport

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Investigation of the Effects of Operational Parameters on Lead Electrorefining in a Fluoborate Medium for Cathodic Process

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## Abstract

Electrorefining, electrowining, electroplating and electrodeposition are main chain of electrolysis process. Refined lead (> 99.99%) can be produced by the electrorefining of impure lead anodes. The process relies on the selective dissolution of lead which leaves behind a strong and adherent layer of solids (slimes) containing the noble impurities originally present in the anode.in this paper the effect of parameters such as current density, concentration solution, temperature, free acid, anode-cathode distance and electrolyte circulation on the efficiency of cathodic process was investigated. This process was the use of the $HBF_4$-$Pb(BF_4)_2$ electrolyte. With increasing current density, temperature, free acid and concentration solution, the efficiency of cathodic process was increases. When electrolyte circulation started the efficiency was increased. By increasing anode-cathode distance, current density decreased and therewith the cathodic efficiency (CE%) was decreased.

**Keywords:** Lead, Electrorefining, Operational Parameters, Fluoborate medium.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Investigation of The Effects of Gelatin on The Quality of Deposits on Different Cathodes in Lead Electrodeposition Process in a Fluoborate Medium

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## Abstract

The formation of defects on the surface of the cathode is harmful and should be prevented. Because when the rough surfaces of deposits grow and become closer to the anode, which is caused a short circuit, and also porous surface is caused waste materials detention between the pores and the roughness which were caused formation of impurities on cathode. In this paper the effects of gelatin as additive on the electrodeposition of lead (in acid fluoborate medium, Free $HBF_4$ = [0.78 M], $Pb^{2+}$ as $Pb(BF_4)_2$ =[0.078 M] ) on lead and copper as cathodes, were investigated. The deposition process was studied by means of cyclic voltammetry for determining dendritic region and scanning electron microscopy (SEM) for investigation of morphology of a Pb deposit formed on cathodes. The gelatin plays a major role in the improvement of quality of deposits and good effect on potential of dendritic growth region.

**Keywords:** Lead, copper, electrodeposition, scanning electron microscopy (SEM), Fluoborate medium.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Synthsis of ZnO nanoparticles and application of it in preparation of epinephrine electrochemical sensor

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**Abstract**
Nanotechnology and nanoscience represent new and enabling platforms that promise to provide a broad range of novel uses and improved technologies for environmental, biological and other scientific applications. The direct electrochemistry of epinephrine (EP) on a modified carbon paste electrode (CPE) was described. The electrode was modified with Zinc oxide (ZnO) nanoparticles and 1,3-dipropylimidazolium bromide as a binder. The oxidation peak potential of EP at the surface of the ionic liquid ZnO nanoparticle CPE (IL/ZnO/NP/CPE) appeared at 350 mV, which was about 80 mV lower than the oxidation peak potential at the surface of the traditional carbon CPE under a similar condition. On other hand, the oxidation peak current was increased for about three times at the surface of IL/ZnO/NP/CPE compared to CPE. The linear response range and detection limit were found to be 0.09–800 μmol $L^{-1}$ and 0.06 μmol $L^{-1}$, respectively. Other physiological species did not interfere in the determination of EP at the surface of the proposed sensor in the optimum condition. The proposed sensor was successfully applied for the determination of EP in real samples.

**Keywords:** Epinephrine; Ionic liquid; ZnO nanoparticle; Sensor; Modified electrode

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Kinetic study of chloromethylation of polystyrene in the presence of ionic liquids

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## Abstract:

In this research, the solubility of polystyrene in the aqueous solution of the cationic, anionic and nonionic surfactants with and without ionic liquids (1-Butyl-3-methylimidazolium tetrafluoroborate, 1-butyl-3-methyl imidazolium bromide) was investigated using UV-Vis spectrophotometry method. Using spectroscopic data, the solubility as a function of different concentrations of surfactants and ionic liquids was plotted. It was found that a maximum solubilization of polystyrene in aqueous phase occurred in the presence of a certain concentration of ionic liquids. The reaction rate constant of chloromethylation of polystyrene in aqueous solution of surfactants was determined Based on the results of solubility diagrams. Experimental results show that the surfactant micelles increase the polystyrene choloromethylation reaction rate by solubilization of polystyrene distributed in carbon tetrachloride phase and bringing into aqueous phase. Chloromethylation degree is measured by determining the amount of chloride which is produced from reaction between chloromethylated polystyrene and tertiary amine using an ion-selective electrode (ISE).

**Keywords : Ionic liquids, Micellar catalysis, Polystyrene, Chloromethylation**

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Synthesis and application of ruthenium (II) complex-ZnO/CNTs nanocomposite in carbon paste matrix for simultaneous determination of ascorbic acid, NADH and folic acid

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**Abstract**
This paper describes the development, electrochemical characterization and utilization of a novel modified ruthenium (II) complex-ZnO/CNTs carbon paste electrode (Ru(II)/ZnO/CNTs/CPE) for the electrocatalytic determination of ascorbic acid (AA). The objective of this novel electrode modification was to seek new electrochemical performances for the detection of AA in the presence of nicotinamide adenine dinucleotide (NADH) and folic acid (FA). The peak potentials recorded in a phosphate buffer solution (PBS) of pH 7.0 were 170, 500 and 830 mV vs. Ag/AgCl/KClsat for AA, NADH and FA, respectively. The peak currents were linearly dependent on AA, NADH and FA concentrations using square wave voltammetry (SWV) method at the ranges of 0.008–251, 1.0–650, and 3.0–700 µmol L-1, with detection limits of 0.005, 0.5, and 1.0 µmol L-1, respectively. The modified electrode was used for the determination of AA, NADH and FA in biological and pharmaceutical samples.

**Keywords:** Ascorbic acid, NADH, Folic acid, Sensor

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical Behavior and Determination of Phenylephrine at Room Temperature Ionic Liquid/Multi-Walled Carbon Nanotube Modified Electrode in the Presence of Acetaminophen

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## ABSTRACT

In this work, carbon ceramic electrode modified with multi-walled carbon nano tubes/ionic liquid (1-Ethyl-3-methyl-imidazolium tetra fluoro Borate), (MWCNTs-IL/CCE) was fabricated and the electrochemical behavior of phenylephrine on the modified electrode was investigated at physiological pH 5.0 by cyclic voltammetry (CV) and differential pulse voltammetric (DPV) techniques. During the oxidation of phenylephrine on the MWCNTs-IL/CCE; one reversible oxidation peak is observed. It was found that a maximum current response can be obtained at pH 5.0 in phosphate buffer solution. The oxidation peak current was found to be linearly related to phenylephrine concentration in the range of 0.2-50 µM with a detection limit of 0.14 µM. Also, the modified electrode shows an excellent analytical performance for for the simultaneous determination of phenylephrine and acetaminophen. The MWCNTs-IL/CCE in the DPV technique phenylephrine and acetaminophen gave sensitive oxidation peaks. This passer-by, a sensitive DPV procedure was developed for the simultaneous analysis of phenylephrine and acetaminophen.

**Keywords***:* Phenylephrine, Acetaminophen, Ionic Liquid, Multi-Walled Carbon Nanotube, Modified Electrode

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

Tehran, Iran University of Tarbiat Modares,

# Electro-oxidation and determination of acyclovir at glassy carbon electrode modified with an imidazolium-based ionic liquid and Pt nanoparticles

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## Abstract

An ionic liquid (IL), 1-buthyl-3-(3-trimethoxysilyl propyl) imidazolium bis (trifluoromethylsulfonyl) imide was covalently attached onto the glassy carbon electrode (GCE) then Pt nanoparticles were synthesized on GCE, and the electrocatalytic oxidation of acyclovir was investigated using the electrodes. Electrochemical oxidation of acyclovir in phosphate buffer (pH=7.4) was performed using cyclic and differential pulse voltammetry. Acyclovir showed an irreversible oxidation peak at about 0.97 V. The modified GCE greatly increased the oxidation signal of acyclovir in comparision with the unmodified GCE. The influences of scan rate were examined on the oxidation signal of acyclovir. Under optimized conditions, for calibration curves of DPV method, two linear ranges were observed; $5\times10^{-7}$ to $6\times10^{-6}$ M, and $1\times10^{-5}$ to $8\times10^{-5}$M the detection limits were $1.04\times10^{-6}$ M, $1.66\times10^{-6}$ M respectively. This method can be employed in quality control and routine determination of acyclovir in pharmaceutical samples.

**Keywords:** Electro-oxidation, Modified GCE, Acyclovir, Pt nanoparticles, Ionic liquid.

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrocatalytic determination of homocysteine, acetaminophen and folic acid using modified nanocomposite carbon paste electrode

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## Abstract

The electrooxidation of homocysteine (Hcy), acetaminophen (AC), folic acid (FA), and their mixture has been studied using an *N*-(3,4-dihydroxyphenethyl)-3,5-dinitrobenzamide modified NiO/CNTs paste electrode and cyclic voltammetry, chronoamperometry, electrochemical impedance spectroscopy and square wave voltammetry methods. The sensor exhibited potent and persistent electron mediating behavior followed by well separated oxidation peaks towards Hcy, AC and FA with activation overpotential. Also, the values of catalytic rate constant (k), and diffusion coefficient (D) for Hcy were calculated. The modified electrode was used for the determination of these compounds in biological and pharmaceutical samples.

**Keywords:** NiO/CNTs nanocomposite; Homocysteine; Acetaminophen, Folic acid.

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Thermodynamic study of the (NaCl+Urea+Water) system using potentiometric method

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## Abstract

In this work, the results relating to the mean activity coefficient measurements for NaCl in the NaCl+Urea+$H_2O$ system using potentiometric method are reported. The potentiometric measurements were performed on the galvanic cell of the type: Ag|AgCl|NaCl (m), Urea (wt%), H2O (1−wt) %|Na-ISE, in various mixed solvent systems containing 0, 10, 20 and 30% mass fractions of Urea over ionic strength ranging from 0.001 to 3.000 $kgmol^{-1}$ at 298.2 K . Sodium ion selective electrode was made in laboratory with modified carbon nanotube as electrochemical sensor. The Deby- Hückel and Pitzer ion-interaction model were used for the experimental data correlation and calculation of thermodynamic properties such as excess free Gibbs energy and osmotic coefficients for under investigated system. The results clearly indicate that a good correlation is obtained with the Pitzer model to describe this system

### Keywords

Thermodynamic study, Mixed solvent system, Potentiometric method, modified carbon nanotube

### References

[1] B. Ghalami-Choobar, F. Sayyadi-Nodehi, J. Chem. Thermodyn. 49 (2012) 104–113.
[2] B. Ghalami-Choobar, M. Mohammadian, J. Mol. Liq. 154 (2010) 26–30.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Modified Electrode Based on Electroactive Ionic Liquid Functionalized Mesoporous Silica

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## Abstract

Ionic structure and conductivity, tunable hydrophobicity and very low volatility are the properties of room temperature ionic liquids (RTIL) that make them attractive for electrochemical applications.[1] But the slow mass transfer is known as their disadvantage. In this respect, immobilization of RTIL on the electrode surface represents a suitable alternative approach. Herein, a modified electrode with ordered mesoporous silica thin film has been constructed for immobilization of ionic liquids. The desired silica nanostructure was deposited on the electrode using an electrochemical method known as electrochemically assisted self-assembly.[2] TEM analysis showed that the desired silica film has uniform thickness with aligned and accessible mesochannels to the electrode surface. The possibility of the immobilization of 1-hexyl-3-methylimidazolium iodide and 1-hexyl-3-methylimidazolium triiodide as two ionic liquids bearing electroactive anions have been studied by voltammetric analysis. The results clearly demonstrate the adsorption of positively charged imidazolium ions inside the negatively charged silica mesochannels. This favorable electrostatic interaction simply leads to the adsorption of iodide or triiodide and then immobilization of the desired electroactive ionic liquids. Effect of the supporting electrolyte and the anions of ionic liquids were examined on durability and leaching stability of the electrodes. The triiodie based ionic liquid has extraordinary stability in the presence of various types and concentrations of supporting electrolytes and after 5 hours the electrode showed more than 30 % of the initial currents.

**Keywords**

Electroactive ionic liquid, Ordered mesoporous silica, Modified electrode.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Voltammetric determination of carbidopa using an ionic liquid modified carbon paste electrode

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## Abstract

Parkinson's disease is believed to be related to low levels of the neurotransmitter dopamine in the brain. Therefore, the dopamine precursor levodopa is employed for its treatment. In order to enhance its pharmacological effect, levodopa is generally associated with a peripherical aromatic decarboxylase inhibitor such as carbidopa. This combination is also used to treat tumors, spasms and poor muscle control caused by CO and manganese intoxication, as well as in ophtalmology (amblicopia and strabismus) [1].

Nanomaterials such as nanoparticles, carbon nanotubes, or nanocomposite connected with biomolecules are being used for several bioanalytical applications [2]. In recent years, different groups have constructed biosensors based on tin-doped ZnO thin films, Nafion-doped carbon nanoparticles, gold nano-wires and ZnO nanoparticles.

Room temperature ionic liquids (RTILs) have been generating increasing interest over the last decade. As a new green medium, RTIL has many unique electrochemical properties, such as higher ionic conductivity and wider electrochemical windows.

In this study, a carbon paste electrode modified with ionic liquids was used to prepare a novel electrochemical sensor for the detection of carbidopa. This electrochemical sensor was used for determination of carbidopa in some real samples.

**Keywords:** Carbidopa; Modified electrode; Voltammetric determination

**References:**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Preparation of an electrochemical bionanosensor for quercetin determination in food samples

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**Abstract**

In this study, a simple and rapid analytical method development for quercetin determination in food samples by using square wave voltammetry (SWV) method on NiO/CNTs nanocomposite ionic liquid modified carbon paste electrode. For this, several parameters, such as NiO/CNTs nanocomposite, ionic liquid ratio, and pH, have been studied. The square wave showed an irreversible oxidation peak at 0.23 V (vs. Ag/AgClsat), which corresponded to the oxidation of quercetin. Compared to common carbon paste electrode, the electrochemical response was greatly improved. Under the optimized conditions, the oxidation peak current of quercetin showed linear dynamic range 0.08–400 μmol $L^{-1}$ with a detection limit of 0.03 μmol $L^{-1}$, using the SWV method. The proposed sensor was successfully applied to the determination of quercetin in apple (golden and green) and onion samples without previous preparation and was compared with a published electrochemical method.

**Keywords:** Quercetin; Ionic liquid; NiO/CNTs nanocomposite; Sensor; Modified electrode

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# A Novel Electrochemical Sensor for Determination of Creatinine Based Carbon Nanofiber/ Cu-Nanowire &Ionic Liquid

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## Abstract:

Creatinine (2-amino-1-methyl-2-imidazoline-4-one) is the final product of creatine metabolism in muscle of mammals and is mainly filtered out of blood in kidneys. High creatinine blood levels indicate serious kidney damage or disease, and kidney damage. In this work we present a novel electrochemical amperometric sensor for determination of creatinine based on carbon nanofiber (CNFs), Cu-nanowire and ionic liquid (IL). The prepared nanocomposite used to modification of glassy carbon electrode.The GC/CNF/Cu-Wire/IL- electrode used as a sensetive sensor for determination of creatinine. Electrocatalytic activity of fabricated sensor was evaluated by cyclic voltammetry. The results indicated that the modified electrode has good electrocatalytic activity toward electrooxidation of creatinine in low potential range. Flow injection amperometric determination of insulin at this modified electrode yielded a calibration curve with the following characteristics; linear dynamic range up to 500μM, sensitivity of 52μA $mM^{-1}$ $cm^{-2}$ and detection limit of 100 nM. In addition interference effect of the electroactive existing species (uric acid, and ascorbic acid) was diminished.

**Keywords:** Creatinine, Cu-nanowire, Carbon nanofiber

**References:**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Thermodynamic study of the (NaCl+Urea+Water) system using potentiometric method

**B. Ghalami-Choobar[1*], D. Nezhadi-Salami[2]**

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## Abstract

In this work, the results relating to the mean activity coefficient measurements for NaCl in the NaCl+Urea+$H_2O$ system using potentiometric method are reported. The potentiometric measurements were performed on the galvanic cell of the type: Ag|AgCl|NaCl (m), Urea (wt%), H2O (1−wt) %|Na-ISE, in various mixed solvent systems containing 0, 10, 20 and 30% mass fractions of Urea over ionic strength ranging from 0.001 to 3.000 $kgmol^{-1}$ at 298.2 K . Sodium ion selective electrode was made in laboratory with modified carbon nanotube as electrochemical sensor. The Deby- Hückel and Pitzer ion-interaction model were used for the experimental data correlation and calculation of thermodynamic properties such as excess free Gibbs energy and osmotic coefficients for under investigated system. The results clearly indicate that a good correlation is obtained with the Pitzer model to describe this system

### Keywords

Thermodynamic study, Mixed solvent system, Potentiometric method, modified carbon nanotube

### References

[1] B. Ghalami-Choobar, F. Sayyadi-Nodehi, J. Chem. Thermodyn. 49 (2012) 104–113.
[2] B. Ghalami-Choobar, M. Mohammadian, J. Mol. Liq. 154 (2010) 26–30.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

Tehran, Iran University of Tarbiat Modares,

# Numerical simulation of mass transfer in wool textile with consideration of electric double layer

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## Abstract

Most solid surfaces carry electrostatic charges. It will produce an electrical surface potential. If the liquid contains a very small number of ions, the electrostatic charges on the non-conducting solid surface will attract the counter ions in the liquid. The rearrangement of the charges on the solid surface and the balancing charges in the liquid is called the electrical double layer (EDL). Many physical problems of fluid dynamics involve the EDL, such as heat exchangers, pumps, combustors, gas absorbers, fuel processors, and biochemical analysis instruments.

Our model numerically simulates contaminant movement in a wool textile with consideration of electric double layer (EDL) by using numerical simulation (Based on the Poisson-Boltzmann equation for electric double layers and Navier-Stokes equation for liquid flows) using the advection–dispersion equation. This is the wool model to give time-dependent results and to model the transport of contaminants within the textile. The numerical model was solved using finite volume method. With specification of initial and boundary conditions, the distributions of the contaminants have been obtained.

**keywords**: Electric double layer, Mass transfer, Numerical simulation, Wool washing machine

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# The Application of Electrochemistry in the Leaching of Gold – Silver Ores

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## Abstract

Since 1954, there have been numerous studies on the leaching and electrochemistry of gold cyanidation. The leaching and electrochemistry of gold, silver and gold–silver alloys in the presence of cyanide and other leachants have been investigated by several researchers using air, oxygen and/or other oxidants in the presence or absence of heavy metal ions as well as sulphide minerals. The anodic dissolution of pure gold in aqueous cyanide may be retarded by the formation of a AuCN or passive film on the gold surface. In the case of Thiosulphate leaching of gold–silver ores, this film could be consisting of sulphur components. Potentiodynamic and galvanodynamic methods can be used to detect passivating films on the surface of gold-silver electrodes. In addition to some useful information on interpretation and use of different current-potential diagrams, this article presents different electrochemical measurement systems that have been used in the leaching processes.

**Keywords:** Gold-silver; Leaching; Electrochemistry.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013
University of Tarbiat Modares, Tehran, Iran

# Electrochemical investigation of atmospheric leaching of sphalerite in sulphate solution

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**ABSTRACT**

Atmospheric leaching is newer method for dissolution of sphalerite (main mineral of zinc). dissolution of sphalerite in atmospheric leaching method due to the formation sulfur layer around the particles has slow kinetic.

This study aimed to identify the kinetic mechanism of atmospheric leaching sphalerite. The electrochemical studies to investigate the behavior and reactions of dissolution of sphalerite during the dissolution process is carried out in different environments and conditions that the most important used in this study is the method of cyclic voltammetry.

In this study was done with different concentrations of ferric sulfate as the Oxidant and hydrogen peroxide and Potassium permanganate as auxiliary Oxidant (oxidation of ferrous iron to ferric ion.

According to result of cyclic voltammetry tests, increase of solution potential caused increase of oxidation of sphalerite and formation of sulphure layer. So kinetics of the reaction increases.

**Keywords:** Sphalerite, Atmospheric leaching, electrochemical, of cyclic voltammetry, kinetic.

**9th Iranian Annual Seminar of Electrochemistry**

**4 , 5 December 2013**

**University of Tarbiat Modares, Tehran, Iran**

# High selective methadone sensor based on ion selective electrode with Potassium tetrakis[3,5-bis-(trifluoromethyl)phenyl]borate as an ionophore

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## Abstract

We demonstrate here a novel potentiometric sensor based on polymeric membranes for determination of methadone [1-4]. The construction of the ion selective electrode is made of Potassium tetrakis[3,5-bis-(trifluoromethyl)phenyl]borate (KTFPB) as an unselective ionophore and 2-nitrophenyl octyl ether (NPOE) as a plasticizer. One drop of this cocktail is put on the poly propylene membrane. To create selectivity in ion selective electrode, the (KTFPB) with negative charge is applied [5-7]. The operational pH range is 5- 6 which is three order less than pKa of methadone (pka=8.25). In this pH range, methadone is a cation which can interact with KTFPB. KTFPB is not a selective ionophore but in conditioning procedure with methadone, the selectivity is induced to KTFPB. Application of the poly propylene with low thickness instead of PVC materials in the sensor provides the high diffusion coefficient. The electrode exhibited a nernstian response to methadone. The electrode shows a wide dynamic linear range for methadone from $10^{-7}$ to $10^{-3}$ M. The observed limit of detection and % RSD are $5\times10^{-7}$ M and 1.8%, respectively. Finally, the proposed method is applied to the determine methadone in urine and medicinal tablet.

**Keywords:** methadone; Potassium tetrakis[3,5-bis-(trifluoromethyl)phenyl]borate; ion selective electrode; potentiometry;

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Fabrication of poly(Ani-co-OAP) on pencil graphite electrode:application to the selective voltammetric detection of acetaminophen in pharmaceutical samples

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## Abstract

A poly(aniline-co-o-aminophenol) was successfully synthesized on a pencil graphite electrode (PGE) by electrochemical copolymerization using a scan potential range from -0.3 to +1.3 V in 0.5 M $H_2SO_4$ containing 20 mM aniline (Ani) and 1 mM o-aminophenol (OAP). The poly(Ani-co-OAP)/ PGE exhibited excellent electrocatalytic oxidation of acetaminophen (AP) in Britton-Robinson buffer solution (BR, pH 4.0). The anodic peak potential of AP was observed in +0.6 V at the poly(Ani-co-OAP)/ PGE (copolymer modified electrode). Under the optimum conditions, the linear calibration curves were obtained in the range of 10-200 µM for AP. The limit of detection (LOD) was estimated to be 5.0 µM based on the signal-to-noise ratio (S/N = 3). The practical application of the modified electrode was demonstrated by the determination of AP in real samples. The voltammetric responses demonstrated an excellent selectivity for AP determination in different pharmaceutical dosage formes.

**Keywords:** poly(aniline-co-o-aminophenol); electrochemical copolymerization; acetaminophen; pencil graphite electrode

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Voltammetric determination of dopamine using a ZnO nanoparticles modified carbon paste electrode

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## Abstract

Dopamine is an important neurotransmitter that belongs to the catecholamines group and plays a very significant role in the central nervous, renal, hormonal and cardiovascular systems [1]. The nano-size materials has recently gained attention for their unique features which are different from macromolecules in their quanta effect, regional confinement of matter, and high surface areas, etc. Electroanalytical methods have attracted more attention in recent years for environmental and biological compound determination due to their sensitivity, accuracy, lower cost, and simplicity [2].

In this study, a carbon paste electrode modified with ZnO nanoparticles was used to prepare a novel electrochemical sensor for the detection of dopamine. Under the optimum pH, the oxidation of dopamine occurs at a potential about 220 mV less positive than that of the unmodified CPE. The present method was applied to the determination of dopamine in real samples.

**Keywords:** Dopamine; ZnO nanoparticles; Carbon paste electrode; Voltammetry

**References:**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Conducting Polypyrrole Film Doped with Anionic Chromotropic Acid as a Solid State Potentiometric Sensor for Cr(VI)

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## Abstract

Present research describes the preparation and the performance of polypyrrole film doped with anionic chromotropic acid as a solid state potentiometric sensor for Cr(VI). Polypyrrole (PPY) films were obtained on different substrates by anodic electropolymerization using chromotropic acid disodium salt (CHR) as anionic dopant. The deposition of PPY film has been performed by the means of cyclic voltammetry. The effect of polymerization condition on the characteristics of potential response of the sensor towards Cr(VI) was investigated. The concentration of pyrrole and CHR, the electrode substrate, the number of voltammetric cycles and pH were optimized. Under the optimized conditions, the proposed sensor works satisfactory in the concentration range of $10^{-4}$ to $10^{-1}$ mol $L^{-1}$ of chromate ion with a quasi Nernstian slope of 32 mV $decade^{-1}$ activity and a fast response time of 30 s. The developed sensor has been applied for the potentiometric determination of chomate in industrial wastewater samples.

**Keywords:** Chromotropic acid disodium salt, Polypyrrole, Chromate, Ion selective electrode.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Application of a new Graphene-based material as a gas sensor with high sensitivity for detection and determination of Ethanol vapor

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## Abstract

In this research, a gas sensor based on chemiresistor device was developed for the determination of ethanol vapor. Graphene foam was used for the preparation of gas sensor. Freestanding, oltra-light weight graphene foams displayed a whole set of new and unique properties that add interest to graphene, the wonder material. The graphene foam has a high surface area due to its porous nature, giving it a high electrochemical capacitance. One essential application of graphene foam is in chemical sensing field because of its high surface area.The graphene - based sensors can detect gases at room temperature whereas commercial sensors require high temperatures for proper functioning [1]. In this study, first, graphene oxide was synthesized using two oxidation steps[2,3], and then the graphene foam fabricated by a typical hydrothermal method [4]. Gas sensor prepared from graphene foam, showed high sensitivity comparing to other similar vapors to the ethanol vapor with satisfactory selectivity.

**Keywords:** Gas sensor; grapheme foam; ethanol

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4 , 5 December 2013

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# Determination of Trace amount of Ferric Ions with a Novel Liquid Membrane Electrode

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## Abstract

Poly(vinylchloride) (PVC) based membranes of 2,6-di(1H-pyrazol -3-yl) pyridine (L) with NaTPB as anion excluder and Benzyl acetate (BA) as plasticizing solvent mediators were prepared and investigated as $Fe^{3+}$ selective electrodes. The best performance was observed with the membranes having the composition L: PVC: BA: NaTPB in the ratio of 5:32:60:3 (w/w; mg). The electrode exhibits detection limit of $8.0\times10^{-8}$M with a Nernstian slope of 17.5 mV $decade^{-1}$ of activity between pH 4.0 and 10.5. The sensor has a lifetime of about 15 weeks and exhibits excellent selectivity over a number of mono-, bi-, and tri-valent cations including alkali, alkaline earth metal, heavy and transition metal ions. Analytical utility of the proposed sensor has been further tested by using it as an indicator electrode in the potentiometric titration of $Fe^{3+}$ with EDTA. The electrode was also successfully applied for the determination of $Al^{3+}$ in real and pharmaceutical samples.

**Keywords:** Trace amount; Ferric ion; Liquid Membrane

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Development of new Sn(II) – Ion selective membrane electrode based on 2,3-Diphenyl Pyrido [3,2-b] Pyrazine

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## Abstract

A new membrane ion-selective electrode for the determination of trace Sn(II) ions has been developed. The PVC-based membrane was coated on a graphite electrode. The optimum membrane contains 5 wt.% ,3-Diphenyl Pyrido [3,2-b] Pyrazine (L) as ionophore, 60 wt.% NPOE, 31 wt.% PVC and 4 wt.% additive Sodium tetraphenyl Borate. The response was linear from $6.0 \times 10^{-7}$ to $1.0 \times 10^{-1}$ M, slope was 30.3 mV decade$^{-1}$, the pH independent region ranged from 3. 5 to 8.2, a limit of detection of $2.3 \times 10^{-7}$ M was possible and a lifetime of more than 14 weeks was observed. Selectivity coefficients for several ions were obtained by the matched potential method. Results show that, for all cations used, the selectivity coefficients are in the order of $10^{-3}$ or smaller. The proposed sensor was successfully applied to the direct determination of Sn (II) ions in real and synthetic samples.

**Keywords:** Sn(II); Ion selective; 2,3-Diphenyl Pyrido [3,2-b] Pyrazine

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4 , 5 December 2013

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# Determination of Iron(III) by a Novel Potentiometric sensor and Its Application in Pharmaceutical Analysis

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## Abstract

A novel Fe (III) membrane sensor based on 4-(4-metoxyphenyl)-6 –( pyridine -2-yl) pyrimidine -2-amine (L) is presented. The electrode shows a good selectivity for Fe (III) ions with respect to most common cations including alkali, alkaline earth, transition and heavy metal ions. Conductance study of L to Ferric and some other metal ions were carried out and confirmed selectivity toward Fe (III) ions. The electrode comprises 5 % L, 32 % PVC, 60 % BA and 3 % NaTPB. The sensor displays a linear dynamic range between $1.0\times10^{-7}$ and $1.0\times10^{-1}$ M, with a nice Nernstian slope of 20.9 mV per decade and a detection limit of $8.9\times10^{-8}$ M. The potentiometric response is independent of pH in the range of 2.5–10.The proposed sensor posses the advantages of short response time, low detection limit and wide linear dynamic range in comparison with former ones. The electrode was used for determination of $Fe^{3+}$ in some Pharmaceutical samples.

**Keywords:** Iron(III); Potentiometric; Pharmaceutical Analysis

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# 2-Metyl-4-(2-Metylpyrimidine-4-yl) Pyrimidine as a Sensing material in Construction of Cr(III) Sensor

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## Abstract

2-Metyl-4-(2-Metylpyrimidine-4-yl) Pyrimidine (L) was synthesized and stability of its complexes with several alkaline earth, transition and heavy metal ions were studied conductometrically in acetonitryl solution. The resulting 1:1 $Cr^{3+}$-L complex found to be the most stable one among all cation complexes studied. Based on the preliminary results thus obtained, L was used as an excellent sensing material to prepare polymeric membrane (PME) silver-selective electrode. The electrode revealed a Nernstian behavior over wide $Cr^{3+}$ ion concentration ranges ($1.0 \times 10^{-7}$-$1.0 \times 10^{-1}$ M ). The potentiometric responses were independent of pH of the test solution in the range 4.9–9.8. The electrodes possessed advantages of low resistance, relatively fast response time, long lifetimes and, especially, good selectivity relative to a wide variety of other cations. The electrodes were used, as indicator electrodes, in the potentiometric titration of Chromium ion and in the determination of $Cr^{3+}$ ion in real samples.

**Keywords**: Sensor; 2-Metyl-4-(2-Metylpyrimidine-4-yl) Pyrimidine; Cr(III)

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Novel Ion Carrier in Costruction of PVC-Based Al(III)-Selective membrane sensor

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## Abstract

Aluminum is the most abundant metal in the earth crust (8.3%), being surpassed in terms of chemical elements general abundance only by oxygen (45.5%) and by silicon (25.7%). in this work, we used a recently synthesized compound for the preparation of novel polymeric membrane electrode (PME) for highly selective and sensitive determination of $Al^{3+}$ ion. The optimum composition of the membrane was 30wt% poly (vinyl chloride), 60 wt. % NPOE as plasticizer, 7 wt. % ionophore, and 3 wt. % NaTPB as lipophilic salt. The electrodes exhibited linear Nernstian responses to $Al^{3+}$ ion in the concentration range of $5.0\times10^{-7}$ to $5.0\times10^{-1}$M with LOD equal to $1.8\times10^{-7}$ M. The electrode has a response time of 30 s and a useful working pH range of 3.0-9.5. The sensor has a lifetime of about 3 mounts and exhibits excellent selectivity over a number of mono-, bi-, and tri-valent cations including alkali, alkaline earth metal, heavy and transition metal ions.

**Keywords:** Ion Carrier; PVC-Based; Al(III)

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Fabrication and Characterization of a Carbon Nanotube Based Methane Sensor

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## Abstract

Detection of methane is important in our industry, because it is an explosive gas. In this work, we have fabricated and tested a chemiresistive sensor based on single wall carbon nanotubes (SWCNTs) for detection of methane. For this reason, Au interdigitated electrodes were deposited on top of $SiO_2$/Si substrate using RF sputtering method. SWCNTs were dispersed in deionized (DI) water and deposited on the prefabricated electrodes by drop-casting method. Since pure SWCNTs are not sensitive to methane, we modified the surface of SWCNTs by $SnO_2$ nanoparticles. These nanoparticles were deposited on SWCNTs using electron beam evaporation method. The crystallography and morphology of the deposited $SnO_2$ nanoparticles were investigated using XRD and SEM analyses. The results show that in comparison to metal oxide sensors which operate at high temperatures, our sensor can detect methane at room temperature. The recovery of the sensor was possible by exposing it to air.

**Keywords:** Carbon nanotube (CNT); Gas sensor; Methane sensor

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4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical determination of gallic acid using glassy carbon electrode modified with gelatin functionalized graphene nanosheet

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## Abstract

Gallic acid, GA, is one of the main natural phenolic components encountered in green tea, black tea, humid substances, and several other plants. The rapid and accurate detection of gallic acid is of great interest to analytical chemistry because it has not only strong anti mutagenic, anti carcinogenic, and antioxidant activities but also potential health effects which have been found recently. In this work, we developed a simple approach for the preparation of gelatin functionalized graphene nanosheet (Gel-GNS) by chemical reduction of graphen oxide (GO). Moreover, a new electrochemical sensor was developed based Gel-GNS modified glassy carbon electrode (Gel-GNS/GCE). Gel-GNS exhibits excellent electrocatalytic activity to gallic acid (GA) oxidation. Under optimum conditions, the sensor responded linearly to GA with detection limit of $4.7\times10^{-7}$ M. The method has been successfully applied to the determination of gallic acid in sample of black tea.

**Keywords: Gallic acid; Gelatin; Graphene nanosheet**

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Food Contaminants Detection by Bio and Immunosensors

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## Abstract

Biosensors for environmental monitoring has developed greatly in recent years. The advantage of using a biosensor is the short measuring time required, because recognition and signal transduction take place at the same time. Immunosensors are affinity ligand-based biosensor solid-state devices in which the immunochemical reaction is coupled to a transducer. Immunosensors are biosensors based on specific antigen-antibody interactions and in which the transducer detect either directly or indirectly the immunochemical reactions. In the indirect approach, the detection of the immune complex is achieved through the labeling of either the antibody or the antigen depending on the immunoassay format. Direct detection approaches are label-free methods, in which the specific binding event between the antibody and the target analyte (the antigen) is monitored by a change or a variation in physicochemical properties. The objective from this article is a review of applications of bio and immunesensors in food contaminants.

**Keywords:** Food contaminants, Biosensor, Immunosensor

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# First report for simultaneous voltammetric determination of methyldopa, folic acid and glycine

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## Abstract

Methyldopa is an antihypertensive and is the L-isomer of alpha-Methyldopa. Methyldopa is an aromatic-amino acid decarboxylase inhibitor in animals and in man [1]. Folic acid, is a water soluble B vitamin. Vitamin $B_9$ is essential for numerous bodily functions [2]. Glycine is one of the fundamental amino acids. Mutations that lead to the replacement of glycine by other amino acids may result in the malfunction of some proteins, leading to diseases such as osteogenesis imperfecta and Ehlers–Danlos syndrome [3].

In this study, a carbon paste electrode modified with $TiO_2$ nanoparticles and ferroce monocarboxylic acid was used to prepare a novel electrochemical sensor for the detection of methyldopa in the presence of folic acid and glycine. The response of catalytic current with methyldopa concentration showed a linear relation in the range from $2.0\times 10^{-7}$ to $1.0 \times 10^{-4}$M with a detection limit of $8.0\times 10^{-8}$ M.

**Keywords:** Methyldopa; folic acid; glycine; $TiO_2$ nanoparticles

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Copper nanoparticles dispersed in polyaniline matrixe coated on glassy carbon electrode as a glucose sensor

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## Abstract

Conductive polymers exhibit a wide range of novel electrochemical properties. The polymers have been recently used in many applications including sensors, biosensors, batteries and etc. The most widespread biosensor today is the glucose biosensor. It is very often used to measure the glucose concentration in blood. Its application for diabetis patients was also the driving force for the glucose sensor research.Glucose sensing is of significant importance in clinical diagnoses, food industry, and biochemical analyses.

Copper nanoparticles dispersed in polyaniline (PANI) matrixes coated on glassy carbon electrode (GCE), as a novel electrode, was easily synthesized by electropolymerization of aniline on GCE and then electrodeposited copper nanoparticles on PANI electrode. The electrochemical behavior and electro-catalytic activity of Cu nanoparticles/PANI/GCE were characterized by cyclic voltammetry and electrochemical impedance spectroscopy. The morphology of electrodes was characterized by scanning electron microscopy. The electrochemical sensor exhibited strong electro-catalytic activity with toward oxidation of glucose. Moreover, the sensor showed excellent sensitivity, selectivity, and stability.

**Keywords:** polyaniline, copper nanoparticles, sensor, gloucose

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# ZnO @ CuO/Polypyrrole nanocomposite based sensor for simultaneous determination of ascorbic acid, dopamine and uric acid

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## Abstract

Ascorbic acid (AA), dopamine (DA) and uric acid (UA) usually coexist in our body fluids, and play determining roles in human metabolism. Conducting polymers there has been much interest in their potential use in areas such as battery electrodes, corrosion protection and biosensors. Among the various conducting polymers, polypyrrole is one of the most frequently investigated.

ZnO/CuO nanoparticles dispersed in polypyrrole (PPy) nanofibers coated on glassy carbon electrode (GCE), as a novel electrode, was easily synthesized by electropolymerization of pyrrole on GCE and then electrodeposited ZnO and CuO nanoparticles on PPy electrode. The electrochemical behavior and electro-catalytic activity of ZnO and CuO nanoparticles/PPy/GCE were characterized by cyclic voltammetry and electrochemical impedance spectroscopy. The morphology of electrodes was characterized by scanning electron microscopy. The electrochemical sensor exhibited strong electro-catalytic activity towards the oxidation of Ascorbic acid, Dopamine and Uric acid. The modified electrode was successfully used to simultaneously determine AA, DA and UA. The sensor showed excellent sensitivity, selectivity,and stability.

**Keywords:** Polypyrrole nanofiber, ZnO and CuO Nanoparticles, Electrocatalytic oxidation

9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Electrochemical Oxidation of Alanine at Quinazolin Self Assembled Monolayer Modified AgNPs/GCE

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## Abstract

In this research, a chemically modified electrode is fabricated based on quinazolin derivative and silver nanoparticles modified glassy carbon electrode (QAgNPs−GCE). This modified electrode was used successfully for electrocatalytic oxidation of alanine. The peak potential of alanine oxidation at QAgNPs−GCE shifts about 35 and 60 mV to less positive potentials as compared with those at AgNPs-GCE and BGCE in cyclic voltammetry, respectively. The kinetic parameters such as the electron transfer coefficient, α, the heterogeneous rate constant, k', and the exchange current of alanine at the QAgNPs−GCE were calculated. The diffusion coefficient of alanine was calculated. In differential pulse voltammetric determination, the detection limit of alanine was 0.28 µM, and the calibration plots were linear within three ranges. This study has also demonstrated the practical analytical utility of the modified electrode for determination of alanine in real sample.

**Keywords:** Alanine; Self-Assembly; Silver Nanoparticles; Quinazolin derivative

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Simultaneous Determination of Hydroxylamine and Nitrite Based on Self-Assembly of Imidazole on AgNPs/GCE

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## Abstract

An electrochemical hydroxylamine sensor was fabricated by self-assembling imidazole derivative on silver nanoparticles modified glassy carbon electrode (IAgNPs−GCE). By cyclic voltammetry the surface charge transfer rate constant, $k_s$, and the charge transfer coefficient, α, for electron transfer between GCE and electrodeposited imidazole were calculated. The IAgNPs−GCE demonstrated a highly catalytic activity in hydroxylamine oxidation. The total number of electron involved in the catalytic oxidation of hydroxylamine was obtained as 1.97≅2. The standard heterogeneous rate constant, k′, and transfer coefficient, α, between the deposited IMWCN layer and hydroxylamine were obtained. In differential pulse voltammetric determination, the detection limit of hydroxylamine was 0.2 μM, and the calibration plots were linear within three ranges. The IAgNPs−GCE can separate the oxidation peak potentials of hydroxylamine and nitrite present in the same solution. Moreover, the IAgNPs−GCE was used to determine of hydroxylamine and nitrite in water samples.

**Keywords:** Self-Assembly; Hydroxylamine; Nitrite; Silver Nanoparticles

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

University of Tarbiat Modares, Tehran, Iran

# Fabrication of a Small Electrochemical Sensor for Gaseous Carbon Dioxide and Its Application in Amino Acid Analysis

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## Abstract:

In this work, carbon dioxide gas, which is produced from amino acids oxidation, was measured by means of a laboratory-made conductometeric sensor. Sodium periodate was selected as the oxidant and cysteine was chosen as a standard amino acid. The constructed cell has the dimensions of 1cm * 1cm * 0.5cm and volume of 150µL. Sodium hydroxide was used as the absorbent solution and nitrogen as the carrier gas. The measured signal is the difference of solution conduction before and after contact with carbon dioxide gas. Effective parameters on produced signals are validated and optimized. They are as follow: flow rate, pH of absorbent solution, flow rate of carrier gas, reactor temperature, reagents ratio, duration of reaction, pH of reactor internal solution and sampling rate of conductometre measurement. In optimum condition the parameters are as follow: flow rate of absorbent solution 1.53(mL/min), pH of absorbent solution 12.5, carrier gas flow rate 5(mL/min), reactor temperature 80°C, reagents ratio ($Cys:IO_4^-$) is 1:2, reaction time is 20 min, pH of reactor internal solution is 3 and sampling rate is 0.2 sec, response time of the sensor is 25 seconds. The constructed sensor has three linear ranges on the cysteine calibration curve which are: (10-70 ppm), (0.1-10 ppm) and (0.01-0.1 ppm). This sensor has the advantages of increasing sensitivity and better limit of detection over the other reported electrochemical carbon dioxide sensors.

**Keywords**: electrochemical sensor, conductometer, carbon dioxide, amino acid, cysteine

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# High Sensitive Non-enzymatic Glucose Sensor based on $Ni(OH)_2$ Nanoparticles

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## Abstract

A simple and robust non-enzymatic glucose sensor based on nickel hydroxide nanoparticles electrodeposited on graphite electrode (NiNPs\GR) was prepared. The results of cyclic voltammetry (CV) and chronoamperometry demonstrated that the NiNPs\GR electrode displayed high electrocatalytic activity toward glucose in basic solution. The nonenzymatic glucose sensor based on NiNPs\GR showed the highest sensitivity of 2401 $\mu A.mM^{-1}.cm^{-2}$ with the lowest detection limit of 0.53 µM (signal/noise ratio (S/N) = 3) and providing a larger, linear working range (1 µM to 15 mM), in the nonenzymatic glucose sensors that have been reported in the literature. Additionally, its application for detecting glucose concentration of human serum sample showed good agreement with the results obtained from automatic biochemical analyzer.

**Keywords:** Glucose; Non-enzymatic; Nickel Hydroxide; Nanoparticle.

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9th Iranian Annual Seminar of Electrochemistry

4 , 5 December 2013

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# Gas Sensing of Polypyrrole Film Prepared by Zn(II) Catalytic Electrosynthesis on Copper Interdigital Electrodes

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## Abstract

Nano-structured polypyrrole (PPy) film have been successfully electrosynthesized in the presence of oxalate ions as passivation agent. PPy film was electrodeposited on copper interdigital electrodes (IDEs) using chronoamperometry technique. The changes in the resistance of the PPy when it was exposed to different gas were used as a sensory signal. The effect of catalyst concentration, Zn(II)/Py mole ratios and anion dopant type on the coating of IDEs and gas detection of sensor was investigated. The sensitivity of sensor optimized at the Zn(II)/Py= 0.025 mole ratio in the presence of $Cl^-$ ions. A proposed mechanism is catalytic electropolymerization via an intermediate complex formation between Zn(II) and Py and then oxidation of pyrrole to cation radical. The conductometric complexation of pyrrole (Py) with Zn(II) cation has been studied. This sensor was potentially useful to detection of n-butylamine in gas phase. The morphology of PPy film was characterized by SEM and FT-IR spectroscopy.

**Keywords:** Conducting Polymer; Gas Sensor; Catalytic Electrosynthesis; Active Metals; Nano-structure

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# Electrodeposition of $CoO_x$Nanoparticles on Graphene-Zirconium Oxide Nanocomposite: Application to Determination of $H_2O_2$

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## Abstract

Graphene-Zirconium Oxide Nanoparticleshybrid is synthesized through a simple one-step hydrothermal route, where the reduction of GO and the in-situ generation of $ZrO_2$ nanoparticles occurred simultaneously. Characterization of the resultant hybrid material using scanning electron microscopy (SEM),transmission electron microscopy (TEM), X-ray diffraction (XRD) and Raman spectroscopy clearly indicated the successful attachment and homogeneous dispersion of monodisperse$ZrO_2$ nanoparticles with particle sizes of ~5nm to graphene sheets. Potential cycling in $CoCl_2$ natural aqueous solution was used for deposition of cobalt Oxide nanoparticles onto rG-ZrO2 nanocomposite. The formation of cobalt oxyhydroxide film was investigated by SEM and cyclic voltammetry in alkaline and natural aqueous solutions. The electrodeposition of cobalt oxide nanoparticles on the surface of rG-$ZrO_2$nanocomposite appears to be a highly efficient method for the development of a new class of sensitive, stable and reproducible hydrogen peroxide electrochemical sensor. The response to $H_2O_2$ on the modified electrode was examined using cyclic voltammetry and amperometry. The amperometric detection of $H_2O_2$ is carried out at 0.35 V versus Ag/AgCl reference electrode in phosphate buffer solution with pH 7.4.

**Keywords: Cobalt Oxide; Nanoparticle; Cyclic Voltammetry; Graphene-Zirconium Oxide; Amperometry**

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# Investigation and Comparison of YSZ and Ni/Ce-YSZ as Gas Sensor

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## Abstract

Screen-printing technology was developed to fabricate thick film layers of 8YSZ and doped with nickel oxide plus ceria on alumina substrate for use in sensor. The influence of dopant was investigated upon ethanol-sensing properties of YSZ sensor. From the conductivity plot, the activation energy (Table 1) of diffusion was calculated. With increasing temperature, the holes concentrations are increased, so, resistance will reduce [1]. Compared with 8YSZ, sample of 1.5Ni/10Ce-8YSZ shows lower conductivity and higher working temperature. In the samples with low NiO content the NiO is soluble in zirconia matrix which leads to a decrease in conductivity due to the increase of scattering [2], and sensitivity increases with increasing temperature because, the thermal energy is sufficient to overcome the activation energy barrier, so, When the Energy required to be provided for the reactions, the sensor sensitivity reaches its maximum. As a result this dopant degrades the sensing sensitivities.

Table1. The activation energy data of the samples

| sample | 8YSZ | 1.5Ni/10Ce-8YSZ |
|---|---|---|
| Activation Energy (eV) | 0.48 | 1.1 |

**Keywords:** YSZ; Dopant; Sensor

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# $ZrO_2$Nanoparticles-Reduced GrapheneOxideNanocomposite: Synthesis, Characterization and Electrochemical Sensing Application

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## Abstract

We report on the synthesis of $ZrO_2$-rGOnanocomposite and its application for electrochemical sensing and biosensingof important biological compounds. $ZrO_2$-rGO hybrid is synthesized through a simple one-pothydrothermal route. The resultant hybrid material was characterizedusing SEM, TEM, XRD and Raman spectroscopy. Electrochemical studies revealed that the $ZrO_2$-rGO/GC electrode possessed excellent electrocatalytic activities toward the catalytic reduction of $O_2$ and $H_2O_2$ at reduced overpotentials.The response to $H_2O_2$ and glucose on$ZrO_2$-rGO/GC and$GO_X/ZrO_2$-rGO/GC electrodewas examined using cyclic voltammetry and amperometry.The detection limits of these proposed sensors were20nM(for $H_2O_2$) and 80 µM(for glucose). In addition, using differential pulse voltammetry (DPV), the high electrocatalytic activity of the modified electrode toward simultaneous detection of AA,DA and UA compounds was illustrated. We envisage that the $ZrO_2$-rGO hybrid may hold great promise for the development of electrochemical sensors as well as other applications, such as supercapacitors, fuel cells and batteries.

**Keywords:**$ZrO_2$ nanoparticles, reduced grapheneoxide,Hydrothermalsynthesis, Electrochemical sensing, $H_2O_2$, Glucose.

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# Modified Carbon Paste Electrode with Carbon Nanotubes and Ionic Liquid and Decorates by Gold Nanoparticle for Dopamine Sensing

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## Abstract

A novel sensor based on multiwalled carbon nanotubes (CNT), ionic liquid (IL) and gold nanoparticles (NP) was developed for dopamine (DA). In summary, composition of carbon paste electrode (CPE) was optimized by Design Expert software. Optimal conditions were found to be 65% graphite, 5% CNT, 10% IL (1-hexyl-3-methylimidazolium hexafluorophosphate (ImPF6)) and 20% paraffin oil. Then, by using a double pulse technique, gold nanoparticles (60 nm) electrodeposited on modified CPE surface. The modified electrode was characterized using SEM, EDS, XRD and cyclic voltammetry (CV) techniques. The electrochemical behavior of DA was investigated on this sensor. The results indicated that the GNP/CNT/IL modified CP electrode exhibited efficient electrocatalytic oxidation for DA with relatively high sensitivity. Using square wave voltammetry (SWV), the modified CPE exhibited a linear voltammetric response for DA in the concentration range of $1.0\times10^{-6}$ – $5.0 \times 10^{-5}$ mol·L$^{-1}$, with the detection limit of $0.3 \times 10^{-6}$ mol·L$^{-1}$.

### Keywords

Carbon paste electrode, Carbon nanotube, Gold nanoparticle, Dopamine, Sensor.

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# Sensing of anti-HIV drug zidovudine on Ag nanofilm-multiwalled carbon nanotubes modified glassy carbon electrode

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## Abstract

A new zidovudine (ZDV) sensor was fabricated on the basis of nanocomposite of silver nanofilm (Ag-NF) and multiwalled carbon nanotubes (MWCNTs) immobilized on GC electrode. In summary, a mechanochemical method was employed for convert hydrophobic nature of MWCNTs to hydrophilic nature and used for GCE modification. After that, by using an electrochemical method, silver is electrodeposited on surface of prepared MWCNTs/GC electrode. The modified electrodes were characterized by SEM, EDS, XRD, cyclic voltammetry (CV), and linear sweep voltammetry (LSV) techniques. Results showed that the electrodeposited silver has a nanofilm structure and is appropriate for using in sensors. The amperometric technique under optimal conditions is used for the determination of ZDV ranging from 0.1 to 200 ppm with a low detection limit of 0.04 ppm (S/N=3) and good sensitivity. The prepared sensor possessed accurate and rapid response to ZDV and shows an average recovery of 98.6 % in real samples.

### Keywords

Carbon nanotube, Silver nanofilm, Zidovudine, Sensor.

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# Sulfated β-cyclodextrin doped polypyrrole film deposited on pencil graphite as an ion selective electrode for determination of phenobarbital

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## Abstract

In the present research, a conducting polypyrrole (ppy) matrix doped with the sulfated β-cyclodextrins (sβ-CD) was electrosynthesized on a pencil graphite and used as a potentiometric sensor for the detection of phenobarbital. The sβ-CD was immobilized within the ppy backbone during the growth of the polymer at the surface of pencil graphite electrode by means of cyclic voltammetry. The effect of polymerization condition on the characteristics of potential response of the sensor was investigated. The concentration of pyrrole and sβ-CD, the electrode type, the number of voltammetric cycles and pH were optimized. Under the optimized conditions, the proposed sensor works satisfactory in the concentration range of $10^{-3}$ to $10^{-1}$ mol $L^{-1}$ of phenobarbital with a sub-Nernstian slope (~ 40 mV $decade^{-1}$ activity) and a fast response time of 5 s. The developed sensor has been applied for the potentiometric determination of phenobarbital in wastewater and pharmaceutical formulation samples.

**Keywords:** Phenobarbital, sulfated β-cyclodextrin, polypyrrole, ion selective electrode.

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