2nd International Conference on Nanotechnology: Future Prospects in the Region

ICN 2008

Book of Abstracts

Organized and Sponsored by
United Arab Emirates University

Co-Sponsored by
Khalifa University of Science, Technology and Research (KUSTAR)
The University of North Carolina, Greensboro
QuarTek Corporation
Abu Dhabi Company of Onshore Oil Operation (ADCO)
Zakum Development Company (ZADCO)
Abu Dhabi Water and Electricity Authority (ADWEA)
National Research Foundation (NRF)
Abu Dhabi Gas Industries Ltd. (GASCO)
Etisalat

November 17-20, 2008
Abu Dhabi National Exhibition Center (ADNEC)
Abu-Dhabi, UAE

Preface

On behalf of the organizing committee for the 2nd International Conference on Nanotechnology (ICN08) I would like to extend a sincere welcome to all of the delegates. This event comes as the second of a planned series of conferences that will be conducted every two years in the Emirates. The 1st conference took place in 2006 in Al Ain-UAE. This conference coincides with the Asian Nanotechnology Forum Summit that is organized by Khalifa University for Science, Technology and Research.

Nanotechnology has infiltrated almost every industrial sector, creating a broad range of revolutionary products ranging from personalized medicine to efficient energy management materials to next generation computer memory storage devices. The nanotechnology based economy and diversification is expected to continue to grow over the next decade as technology and new discoveries continue to emerge.

The United Arab Emirates as well as other countries in the region has realized the great potential nanotechnology can bring to spark new economy. Thus conferences, like ICN08, become essential for scientists to meet and exchange research results as well as build scientific working relations.

ICN08 have 128 contributions, 4 keynote addresses and 4 invited talks. The organizing committee put a well diverse program that covers contemporary areas of development in nanotechnology with emphasis on novel synthesis and characterization techniques, computational nanotechnology, applications of nanotechnology in biomedical, environmental, and composite sectors and business implications of nanotechnology.

In the future conferences of this series we would like seek your active participation to encourage graduate students as well as new PhD graduate to attend this conference. A key element to prepare the country's industries to embrace the nanotechnology revolution is to prepare graduates to assume a key position in making and creating new technologies. Nanotechnology is estimated to create or impact hundreds of thousands of jobs worldwide over the next decade. Roughly two million new nanoscientists and engineers will be needed worldwide in the next 10-15 years. Some 50 countries have established national initiatives to develop human resources and build research capacity in nanotechnology.

The organizing committee would like to extend a warm thanks to all of the sponsors who contributed in cash and those contributed in-kind. Without their valuable contribution this conference would not have been possible.

I wish you a successful conference and enjoyable stay in the UAE.

Yousef Haik
Conference Chair

Committees

Conference Chair

Yousef Haik

Organizing Committee

Yousef Haik
Khalifa Harib
Ahmad Alawar
Saud Aldajah
Arif Al-Hammadi
Mohammed Al-Mualla
Salah Al Omari
Emad Elnajjar
Sami Habib, Saudi Arabia
Mohammad Hamdan
Saeed Hareb
Saud Khashan
Abdel-Hamid Mourad
Kamal Moustafa
Farag Omar
Tamer Shahin
A.M. Sharif Ullah

Scientific Committee

Imad Abu-yousef, UAE
Sabri Akari, Germany
Marwan Alhaik, USA
Mostafa Anaoloui, USA
Mustafa Anaoloui, USA
Ali Beitoilahi, Iran
Richard Czerw, USA
Sami Habib, Saudi Arabia
Naser Hamdan, UAE
Ben Harrison, USA
Ibrahim Hassan, Canada
Mohammed Islam, UAE
Najeh Jesrawi, UAE
Mazen Khaled, Saudi Arabia
Mohamed Kilani, Jordan
Sufian Khan, UAE
Jonathan Philip, USA
Reyad Sawafta, USA

Contributing Papers

Keynote Addresses

Keynote address – 1

Dream Big, Think Small: MEMS and Nanotechnology for Kids

Marlene Bourne

President & Principal Analyst, Bourne Research LLC - USA

Abstract

From practical household items to amazing robotics, MEMS devices and nanomaterials can already be found in far more products than many people realize, and the possibilities are endless. Learn about today's most exciting applications, where we might find these technologies tomorrow, and how we can engage our children in the exciting promise of next-generation science and engineering.

Keynote address – 2

Can Nanotechnology Solve The Global Water Crisis?

Reyad Sawafta

President and CEO of Quartek incorporation - USA

Abstract

Water shortages and lack of access to safe drinking water will continue to grow as major global problems. Currently, there are more than one billion people that lack access to safe drinking water and more than 2.4 billion people that lack access to proper sanitation, nearly all of them live in developing countries. At present a third of the world's population live in water-stressed countries, and this number is expected to rise to two-thirds by 2025.

This presentation will address emerging global needs with emphasis on the water crisis, and will also detail how Nanotechnology can be the answer to ensuring a safe supply of drinking water for regions of the world that are stricken by periodic drought or where water contamination is endemic by providing water technologies that are relatively simple and inexpensive to install, operate, and maintain.

Keynote address – 3

Calcium Phosphate Nanoparticles as Nano "Solutions" for Bioimaging and Drug Delivery

Mark Kester[a], Thomas T. Morgan[b], Erhan İ. Altınoğlu[b], Timothy J. Russin[b], Hari S. Muddana, James M. Kaiser[a], Brian M. Barth[a], Peter C. Eklund[b], Yasser Heakal[a], Arti Sharma[a], Gavin P. Robertson[a], Amra Tabokov[b], Mylisa R. Parette[b] ,Sarah Rouse[b], Jong K. Yun[a], Victor Ruiz-Velasco[a], James H. Adair[b]

[a] Penn State College of Medicine, Hershey, Pennsylvania 17033
[b] The Pennsylvania State University, University Park, Pennsylvania 16802

Abstract

Paradigm-shifting modalities to more efficiently deliver drugs to cancerous lesions require the following attributes: nanoscale-size, targetability and stability under physiological conditions. Often, these nanoscale drug delivery vehicles are limited due to agglomeration, poor solubility or cytotoxicity. Thus, we have designed a methodology to encapsulate hydrophobic antineoplastic chemotherapeutics within a 20-30 nm diameter, pH-responsive, non-agglomerating, non-toxic calcium phosphate matrix. These calcium phosphate nanoparticles (CPNP) can encapsulate both fluorophores and chemotherapeutics, are colloidally stable in physiological solution at 37°C and can efficaciously deliver hydrophobic antineoplastic agents *in vitro* and *in vivo*. In addition, indocyanine green (ICG) -encapsulated CPNPs exhibit significantly greater intensity at the maximum emission wavelength relative to the free constituent fluorophore, consistent with the multiple molecules encapsulated per particle, increased quantum efficiency and photostability. Optical near infrared bioimaging reveals that PEGylated ICG-CPNPs accumulate in solid, 5 mm diameter xenograft breast adenocarcinoma tumors via enhanced retention and permeability (EPR) within 24 hours after systematic tail vein injection in a nude mouse model. These studies demonstrate that CPNPs may be nano"solutions" for efficient bioimaging and drug delivery.

Disclaimer: Penn State Research Foundation has licensed CPNPs to Keystone Nano, Inc. for commercialization as NanoJackets^{TM}. Drs. Kester and Adair are, respectively, Chief Medical Officer and Chief Scientific Officer of Keystone Nano.

Keynote address – 4

Nanotechnology-Based Minimally Invasive Therapies

Yousef Haik

Abstract

Image-guided magnetic hyperthermia and osteomyelitis therapies based on novel nanoparticles will be presented as examples of nanotechnology-based minimally invasive therapies,

Cancer management using multifunctional magnetic nanoparticles that can serve as imaging contrast agent, targeted drug delivery agent and magnetic hyperthermia agents will be presented. These particles are loaded on nonpathogenic bacteria with affinity to home at tumor sites.

Osteomyelitis is the inflammation of bone tissue caused by infection. Given the FDA approval rate for new antibiotics and the inability of current antibiotics to fully control in vivo bacterial infection, it is clear that there is a great need for unconventional biocidals. Metallic nanoparticles, another possible route for fighting bacterial infection, are investigated in this presentation.

Synthesis 1

Second Generation of Nano-biotechnological products: Novel Assembly and Purification by size Discrimination and selectivity of Nanoparticle Bioproducts

Mohsen Jahanshahi
Nanobiotechnology Research Center, Faculty of Chemical Engineering, Babol University of Technology, IRAN
Corresponding author: Mjahan@nit.ac.ir

Abstract

Second generation of biotechnological products are nanoparticulate in nature. Examples include viruses, plasmids, virus-like particles and nano-protein assemblies variously in manufacture or development as vaccines, drug delivery vehicles and diagnostic tools, or as the components of nano-engineered therapies, implants, nano-motors or nano-sensors. Such products must be manufactured in advanced states of purity, material definition and sophisticated formulation to rival those demanded of the pharmaceutical macromolecules which dominate as first generation products. Nanoparticulates are characterised by a critical size range (20-300 nm diameter) and complexity of surface chemistry and internal organisation which pose new challenges in separation science and engineering, controlled chemistries of modification and material measurement not readily addressed by extant technologies.

However nanoparticles of biodegradable polymers can provide a way of sustained, controlled and targeted drug delivery to improve the therapeutic effects and reduce the side effects of the formulated drugs. Protein nanoparticles generally hold certain advantages such as greater stability during storage, stability in vivo, non-toxicity, non-antigen and ease to scale up during manufacture over the other drug delivery systems. Such assemblies can be manufactured to act as surrogate mimics, or as bona fide nanoparticulate products in their own right (i.e. drug delivery vehicles).

The Nanobiotechnology Group in Babol University of Technology is at the forefront of innovative studies designed to establish technologies appropriate for the manufacture, formulation, purification and delivery of nanoparticulate bioproducts.

Current work is concerned with upstream assembly of nanoparticulates, the means of their fractionation from system impurities, and their formulation for end-use. Considerations of measurement, controlled modification and structural characterisation are common to all programmes.

In the scouting experimentation, protein nanoparticles (from human serum albumin, bovine serum albumin, gelatine and α-lactalbumin) have been assembled as drug delivery systems and also exploited as surrogate mimics for representative products greatly benefit shorter, 'proof of principle' studies conducted with less readily available adenovirus and virus-like nanoparticle preparations. In addition plasmid DNA nanoparticles have been prepared and subsequently purified with novel techniques.

Immobilization of Acetylcholine Esterase by Using Multiwall Carbon Nanotube for a Novel Flow-Through System Sensor

Ebrahimi Hosseinzadeh, Bahman[a], Shojaosadati, Seyed Abbas[a,*], Ranaie Siadat, Omid[b], Noroozi, Parviz[c]

[a] *Biotechnology Group, Chemical Engineering Department, Faculty of Engineering, Tarbiat Modares University, Tehran, Iran*

[b] *Department of Biotechnology, Faculty of Energy and New Technologies, Shahid Beheshty University, Tehran, Iran*

[c] *Department of Science, Tehran University, Tehran, Iran*

[*] *Corresponding author: shoja_sa@modares.ac.ir*

Abstract

A method for immobilization of acetylcholinesterase (AChE) by using sol gel - multiwall carbon nanotube (MWCNT) composite on fixed bed reactor is developed. The method is fast, cheap and automatizable flow-through system which is suitable for detection of organophosphorous insecticides. In this system sol-gel solution was homogeneously distributed in the enzyme-MWNTs which showed a porous structure. The immobilized AChE could catalyze the hydrolysis of acetylthiocholine to form thiocholine, which was then reacted with 5, 5-dithiobis (2-nitrobenzoicacid) to produce detectable color with a Visible spectrophotometer. The results showed that the enzyme immobilized on carbon nanotubes-sol gel were highly effective compared with carbon-sol gel and sol-gel. The scanning electron microscopy (SEM) images were reveald a porous surface comprised of carbon nanotubes and AChE encapsulated in sol-gel. The optimum ratios of AChE/carbon nanotube, and AChE-carbon nanotube/sol gel were found to be 1.05 (630 μl : 600 μl) and 1.35 (1230 μl : 911 μl), respectively. The optimum feeding flow rate and substrate (acetylthiocholine iodide) concentration were found to be 0.34 mi/min and 1 mM, respectively.

Keywords: Flow-through system, Acetylcholine esterase, Acetythiocholine iodide, Sol–gel, Biosensor, Thiocholine, Multiwall Carbon Nanotube (MWCNT)

Encapsulation of Hexadecane containing Fe_3O_4 nanoparticles by coaxial electrospinning of PEO (shell)/HD (core) nanofibers

M. Madani, N. Sharifi-Sanjani

School of Chemistry, University College of Science, University of Tehran, Tehran, Iran

[*] *Corresponding author: mmadani@khayam.ut.ac.ir*

Abstract

There are many situations in which hydrophobic substances need to be encapsulated by hydrophilic polymers, still in the form of fibers. Shape-stabilized, phase change nanofibers (due to the presence of HD as a phase change material, PCMs,) have many potential applications as they are able to absorb, hold, and release large amounts of thermal energy over a certain temperature range by taking advantage of the large heat of fusion of longchain hydrocarbons[1,2]. We have focused on compounds with melting points near room temperature (hexadecane) as these temperature ranges are most desirable for human body and can be used in clothing industry.

Nanofibers containing hexadecane (as PCMs) or paraffin and Fe3O4 nanoparticles as core materials and PEO as shell were electrospun via coaxial electrospinning in to fiber web.

The resultant nanofibers were characterized by means of transmission electron microscopy (TEM), Diffrential Scanning calirometry(DSC) and Thermogravimetric Analysis(TGA). TEM showed that the fibers having a size range of about 300-700 nanometer in diameter. The phase change temperature and phase transition heat of the produced nanofibers were determined by DSC analyses. TGA was also used to prove the capsulation and to determine the amount of hexadecane and Fe3O4 nanoparticles in the nanofibers.

Fabrication of Aligned Piezoelectric Nanofiber by Electrospinning: Morphology, Crystallinity and Crystal Structure

Muhamad Nasir[a,b,*], Masaya Kotaki[b]
[a] *Venture Laboratory, Kyoto Institute of Technology*
b Departement of Advanced Fibro Sciences, Kyoto Institute of Technology
[*] *Corresponding author: mnasir@kit.ac.jp*

Abstract

Aligned piezoelectric PVDF nanofibers with and without hollow morphology were prepared by single spinneret and co-axial electrospinning. Beaded free finer hollow aligned nanofibers have diameter range between 80 to 300 nm. Surface roughness and crystal structure of nanofiber fibers were succesfully controlled by using special ionic additives. Furthermore, crystallinity of aligned fiber was evaluated by differential scanning calorimetry (DSC). Fourier transform infra red (FTIR) and wide angle X-ray difraction (WAXD) analysis of fiber showed that the aligned PVDF nanofiber has rich content 2-phase crystal structure. Advanced discussion will be exposed in this conference such as effect of electrospinning condition such as electrospinning speed on morphology, fiber diametter, crystallinity and crystal structure of hollow PVDF nanofiber. Piezoelectric nanofiber has great potential application in advanced sensor and actuator.

Keywords: Aligned piezoelectric nanofiber; electrospinning; co-axial electrospinning, β-phase PVDF

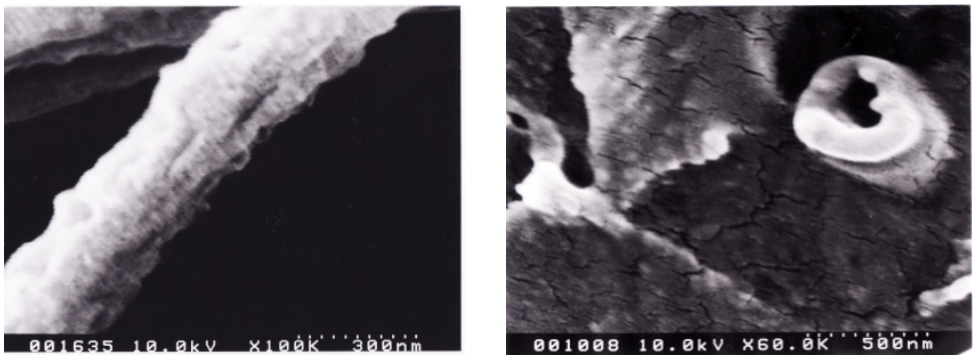


Figure 1. Surface (left) and cross section (right) of piezoelectric nanofiber characterized by field emission scanning microscopy (FE-SEM).

Nanomaterials, their Synthesis and Potential

M. A. Shah[a,*], A. Singh[b]

[a] *EM Laboratory, Department of Physics, National Institute of Technology, Hazratbal Srinagar-190006, India*

[b] *Effat College, P.O Box. 34689, Jeddah 21748, Saudi Arabia*

[*] *Corresponding author: Shah11nit@gmail.com*

Abstract

A versatile technique has been successfully developed for the synthesis of nanomaterials by a simple and soft reaction with water without any additives. This is the first report where water is used as solvent as well as source of oxygen for the synthesis of oxide nanomaterials. The formation of nanomaterials by the reaction of metals with water is suggested to occur due of decomposition of water by the metal giving hydrogen. The reported method is new, economical, fast, environmentally benign and free of pollution, which will make it suitable for large scale production. Promises and potential of nanostructures are discussed in detail.

Keywords: Simple Synthesis, Hydrogen Evolution Reaction, Nanostructures, Promises and potential

Synthesis 2

Sized-controlled ZnO nanoparticles, synthesis and morphology

M. Oftadeh[a,*], M. Salavati-Niasari[b,c], F. Davar[c]

[a] *Department of Chemistry, Faculty of Science, Payame Noor University (PNU), Isfahan, I. R. Iran*

[b] *Institute of Nano Science and Nano Technology, University of Kashan, Kashan, I. R. Iran*

[c] *Department of Chemistry, Faculty of Science, University of Kashan, Kashan, I. R. Iran*

Corresponding author: m_oftadeh@pnu.ac.ir

Abstract

Zinc oxide nanoparticles were successfully prepared through the decomposition of zinc acetylacetonate precursor in oleylamine in the presence of triphenylphosphine. The products were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), Fourier transform infrared (FT–IR) spectroscopy.

Keywords: Zinc oxide, Nanoparticles, Optical properties

Sol gel-derived CDHA/FA nanoparticles from precursors containing a nonstoichiometric Ca/P ratio equal to 1.5

R. Jahandideh[a,*], A. Behnamghader[b], M. Rangi[a], A. Youzbashi[b], M. Daliri[c], S. Joughehdoust[a], R. Tolouei[a], M. Yavari[b]

[a] *Department of Biomedical Engineering (biomaterial), Biomedical Engineering Faculty, Islamic Azad University, Science and research Branch, Tehran, Iran*

[b] *Materials and Energy Research Center, P.O. Box 1455-4777, Tehran, Iran*

[c] *National Institute of Genetic Engineering and Biotechnology*

[*] *Corresponding author: jahandideh_r@yahoo.com*

Abstract

Hydroxyapatite [HA, $Ca_{10}(PO_4)_6(OH)_2$] is one of the types of calcium phosphates, which has extensive applications in the healing of bone and tooth, due to biocompatibility and bioactivity and also similar composition to that of natural bone [1-2]. The bioactivity of HA results in the direct bonding with bone tissue without making fiber capsules [3].

Pure fluorapatite [FA, $Ca_{10}(PO_4)_6F_2$] has more chemical and structural stability in comparison to HA [4]. One method to control the stability of HA could be therefore, the substitution of OH^- by F^- in hydroxyapatite structure and formation of fluorhydroxyapatite [FHA, $Ca_{10}(PO_4)_6(OH,F)_2$] [5].

In this study, the sol-gel processing was used to synthesize the calcium phosphate powders. The advantages of sol-gel method over other methods are precise control of composition, low processing temperature, better homogeneity and so. After the heat treatment at 550°C, phase composition, chemical structure and morphological and size aspects of the powders were characterized.

Synthesis of Cu-Al_2O_3 metal matrix nano composite powder from CuO and Al powders by using of high energy planetary fast milling

Ashkan Motaman*, Esmaeil Salahi

Ceramic department, Materials & energy research center, Tehran, Iran, P.O.Box:14155-4777, Tehran, Iran

* *Corresponding author: Ashkan.Motaman@siemens.com*

Abstract

Cu-Al_2O_3 metal matrix nano composite powder has been synthesized from CuO & Al powders by using high energy planetary fast milling. Mechanical alloying was used to produce 20% Vol. Alumina as a reinforcement phase in copper matrix. Reactive milling between CuO & Al powders cause formation of Cu-Al_2O_3 metal matrix composite. Directly milling of CuO & Al powders is highly exothermic and explosion could occur in milling chambers therefore, Cu (Al) solid solution has been used to win over this problem. It has been observed that mechanical alloying of Cu and Al powders for 50 hours by planetary fast milling with Cu:Al atomic ratio of six, leads to formation of a Cu(Al) solid solution.

After formation of Cu (Al) solid solution, this powder is milled with CuO powder and reaction milling is started. During this reaction, Al solute is extracted from Cu (Al) solid solution and reacted with oxygen and cause formation of alumina particles while copper turning back to pure Cu. Presence of alumina particles has been illustrated by TEM photos. Alumina particles size was smaller than 50 nm.

Keywords: mechanical alloying, Cu – Al2O3 metal matrix nano composite, Cu (Al) solid solution.

Effect of calcium: phosphorus molar ratio and PH on calcium phosphate biomaterials prepared from precipitation method

Esmaeil Salahi*, Iman Mobasherpour
Ceramic department, Materials and energy research center
P.O.Box:14155-4777, Tehran, Iran
* *Corresponding author: Email: kesalahi@yahoo.com*

Abstract

In the present study, solution of, $Ca(NO_3)_2.4H_2O$ and $(NH_4)_2HPO_4$ with different Ca/P molar ratios (1, 1.5, 1.67 and 2) were used as starting materials and mixed at 20^oC at pH value 0-12. The resulting precipitates were studied by means of infrared spectroscopy (IRs) and X-ray diffraction (XRD) techniques before and after heating at 1100^oC for 1 hour. Results showed that as-precipitate and powders are composed of DCP, DCPD, HAP and $Ca(OH)_2$. After heat treatment, the sample of calcium phosphate materials constitutes bi-phase, or even tri-phase bioceramic powders consisting of HAp, TCP, and CaO as crystalline phases.

Keywords: engineering ceramics, particulates and powders, selection of components, biomaterials, calcium phosphate.

New Nanocarrier Systems Based on Polyfunctional Dendrimers with Naturally Occurring Building Block Monomers

H. Namazi
Research Laboratory of Dendrimers and Nanocompounds, Faculty of Chemistry, University of Tabriz, Tabriz, P. O. Box: 51666, Iran
Corresponding author: namazi@tabrizu.ac.ir

Abstract

The synthesis of various generations of new dendritic supramolecules containing polar functional groups in their peripherals based on variety of naturally occurring or biocompatible molecules as the building block monomers is reported. Meanwhile, up to several generations of dendritic supramolecules based on citric acid or amino acids and poly (ethylene glycol) or linear citric acid glycodendrimers was prepared in moderate conditions and their potentials was examined as the new nanocarrier systems. The synthesized amino or carboxylic-terminated dendrimes in our hands are attractive for drug conjugated from a systematic point of view, because of the well developed methodology for formation of amides that has been created in the field of peptide synthesis. Dendrimers as the new molecular tools in medicine and nanotechnology is a very rapidly growing area of science. Their highly branched and well defined structure, globular shape, and controlled surface functionality are important characteristics which make them excellent candidates for evaluation as nanocarrier systems. On the other hand, the synthesized dendrimers having polar groups at their surface, typically amine or carboxylic groups, create the option of using these dendrimers as either an acid or a base for salt-formation with drug molecules. The ability above mentioned dendrimers as the host-guest systems has been investigated and a restricted number of guests, such as rose Bengal and some other drug molecules could encapsulated in their “dendritic box”. Our investigations showed that their transport capacity (TC) were significantly high and enough efficient for applications in biological systems. Also new series of nanocarrier compounds as star shape biopolymer was synthesized using dendritic poly(glycerol) as the core and barbell-like dendrimers from glutamic acid as ABA-type triblock copolymer (PGL-PEG-PGL) by using liquid-phase peptide synthesis method.

Keywords: Dendrimers, Polyfunctional, Nanocarrier, Supramolecule

Parametric study on the synthesis single walled carbon nanotube by gas arc-discharge method with multiple linear regressions and artificial neural network

Jabari Seresht Razieh[a], Jahanshahi Mohsen[a,*], Yazdani Masoud[b], Fatemeh Mohamadzadeh[a]

[a] *Nanobiotechnology Research Lab., Faculty of Chemical Engineering, Babol university of technology, P.O.Box:484, Babol, Iran ,Tel and Fax: +98(0)1113220342*

[b] *Islamic Azad Universities, Central Branch, Tehran, Iran.*

[*] *Corresponding author: mjahan@nit.ac.ir*

Abstract

Carbon nanotube, a new form of carbon element is composed of graphene sheets rolled into closed concentric cylinders with diameter of the order of nanometers and length of micrometers and extensive applications. A challenging problem toward a wide range of application of single-walled carbon nanotubes (SWNTs) relies on the development of a large-scale cost-effective production of SWNTs. The arc discharge method is one of the most efficient techniques for this purpose. Arc discharge is very simple and has merit to make massive and elongated SWCNTs. synthesis of SWCNTs are affected with a number of parameters namely pressure, current, atmosphere and catalyst. Many researches have been carried out to study the effect of these parameters. In this paper a predictive model has performed for prediction diameter of SWCNTs based on these factors.. In this study a linear model were established by subjecting the transformed values of independent variables to multiple linear regression (MLR) analysis. In order to examine the correctness of predicted linear model a predictive back propagation artificial neural network (ANN) model was utilized. The optimization methods developed by both ANN and regression were validated by comparing the results of 10 batches of predetermined data and by a paired t test. These findings demonstrate that ANN provides more accurate prediction and is quite useful in the optimization of diameter SWCNT when compared with the multiple linear regression analysis method. The generic applications of such mathematical methods for these sensitive systems are discussed.

Keywords: single wall carbon nanotube, gas arc discharge, artificial neural network, multiple linear regressions, distribution diameter

Synthesis 3

Synthesis, Characterization and Modeling of Bimetallic (Au/Ag) Normal and Inverted Core-Shell Nanoparticles

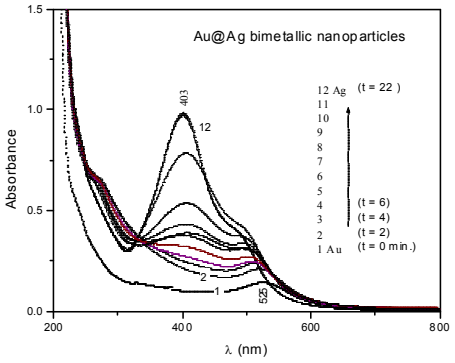
Mudassir M. Husain

Physics Section, Department of Applied Sciences and Humanities, Faculty of Engineering and Technology, Jamia Millia Islamia New Delhi-110025 India

Corresponding author: mmudassirh@rediffmail.com

Abstract

Bimetallic nanoparticles have superior catalytic, electronic, optical and magnetic properties as compared to monometallic nanoparticles. In the present work we have prepared the bimetallic coreshell (Au@Ag and Ag@Au) by chemical synthesis using Beta-cyclodextrin (β-CD) as capping agent. The structure and composition of core shell particles has been characterized by using UV-vis spectroscopy, fluorescence spectroscopy and transmission electron microscopy (TEM). From the average size we have tried to model the absorption spectra of the mono and bimetallic systems using Mie theory.



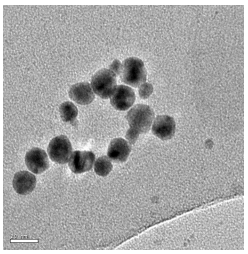
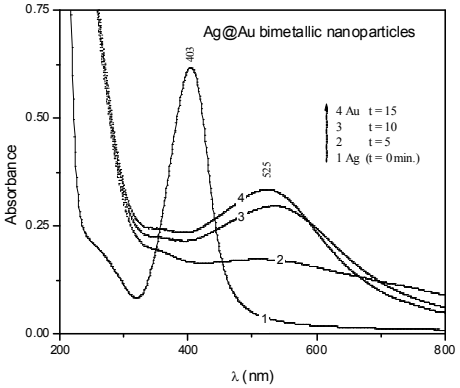


Fig. 1
Absorption spectra of Au@Ag, showing the peak shift from Au to Ag with time (left); TEM (above)



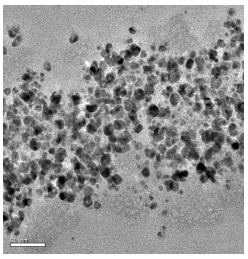


Fig. 2
Absorption spectra of Ag@Au, showing the peak shift from Ag to Au with time; TEM (above)

Synthesis of Cobalt and Cobalt Oxide Nanoparticles and Their Magnetic Properties

Masoud Salavati-Niasar[a,b,*], Fatemeh Davar[b]

[a] *Institute of Nano Science and Nano Technology, University of Kashan, Kashan, P. O. Box. 87317-51167, I. R. Iran*

[b] *Department of Chemistry, Faculty of Science, University of Kashan, Kashan, P. O. Box. 87317-51167, I. R. Iran*

[*] *Corresponding author: salavati@kashanu.ac.ir*

Abstract

In recent years, there has been an increasing interest in developing materials with low-dimensional nanostructure due to their potential technological application in nanoscale devices. Also, it has been obvious that their properties depend sensitively on their size and shape. Therefore, the challenges in nanocrystal synthesis are to control not only the crystal size but also the shape and morphology. In order to produce the desired nanostructural materials, various method have been developed, such as electrodeposition, molecular beam epitaxy (MBE), hydrothermal methods, chemical reactions, homogeneous precipitation, sol-gel, and deposition on a support. Among various techniques developed for the synthesis of magnetic nanoparticles, thermal decomposition is one of the most common to produce stable monodisperse suspensions with the ability of self-assembly. Nucleation occurs when the metal precursor is added into a heated solution in the presence of surfactant, while the growth stage takes place at a higher reaction temperature. On the other hand, the preparation of metal nanostructures by thermal decomposition of complexes becomes increasingly important mainly due to the easy control of process conditions, particle size, particle crystal structure, and purity.

The present investigation reports, the novel synthesis of Co and Co_3O_4 *via* thermal decomposition a new precursor, [Bis(salicylidene)cobalt(II)] without any additional reducing agents. Use of the novel compound can be useful and open a new way for preparing nanomaterials to controlling nanocrystal size, shape and distribution size. First, the $[Co(sal)_2]$–oleylamine complex was prepared by reaction of $[Co(sal)_2]$ and oleylamine. The mixed solution was placed in a 50ml three-neck distillation flask and heated. During all the experimental processes, the flask was flushed with high-purity Ar gas to avoid oxidation. The colloidal nanoparticles was collected, washed and dried. Physicochemical characterization of nanoparticles obtained has been characterized using TEM, XRD, XPS and FT-IR. Magnetic properties of the prepared sample were investigated by VSM. TEM analysis demonstrated nanoparticles cobalt with an average diameter of about 25 nm. The hysteresis loops of the obtained samples reveal the soft magnet behaviors the enhanced coercivity (*Hc*) and decreased saturation magnetization (*Ms*) in contrast to their respective bulk materials. These nanoparticles were spherical monodisperse and uniformed.

Synthesis of Monodisperse Mn_3O_4 Nanocrystals

Masoud Salavati-Niasar[a,b,*], Fatemeh Davar[b]

[a] *Institute of Nano Science and Nano Technology, University of Kashan, Kashan, P. O. Box. 87317-51167, I. R. Iran*

[b] *Department of Chemistry, Faculty of Science, University of Kashan, Kashan, P. O. Box. 87317-51167, I. R. Iran*

E-mail: salavati@kashanu.ac.ir

Abstract

The development of nanoparticles has been intensively pursued, not only for their fundamental scientific interest, but also for many technological applications. Mn_3O_4 is one of the most stable oxides of manganese. Mn_3O_4 synthesis has gained significant attention due to its wide range applications, such as high-density magnetic storage media, catalysts, ion exchange, molecular adsorption, electrochemical materials, varistors and solar energy transformation. Among various techniques developed for the synthesis of MnO and Mn_3O_4 nanoparticles thermal decomposition is a novel method to produce stable monodispersed and it is a rapidly developing research area. As compared to conventional method, it is much faster, cleaner and economical. A variety of materials like carbide, nitride, sulfides and metal oxides have been synthesized by thermal decomposition method. A major interest at the moment is in the development of organometalic or inorganic compound for preparation of nanoparticles.

The present investigation reports, the novel synthesis of nanoparticles Mn_3O_4 using thermal decomposition and its physicochemical characterization. To the best our knowledge, this is the first report on the synthesis of monodispersed manganese oxide nanoparticles. First, the $[Mn(sal)_2]$-oleylamine complex was prepared by reaction of $[Mn(sal)_2]$ and oleylamine. The mixed solution was placed in a 50 ml three-neck distillation flask and heated. The resulting metal-complex solution was injected into triphenylphosphine and then colloidal nanoparticles were generated. The solution was then cooled to room temperature. The nanonparticles were precipitated by adding excess ethanol to the solution. The precipitated nanoparticles were retrieved by centrifugation. In this research work the nanoparticles Mn_3O_4 powder have been prepared using [Bis(salicylidiminato)manganese(II)] as precursor. Effect of oleylamine and triphenylphosphine on particle morphology has been investigated. Transmission electron microscopy (TEM) analysis demonstrated nanoparticles Mn_3O_4 with an average diameter of about 20 nm. Nanocrystals of Mn_3O_4 obtained has been characterized using SEM, XRD, XPS and FT-IR. It is noteworthy that nanoparticles Mn_3O_4 synthesis using thermal decomposition method.

Nanocluster device fabrication using V-grooves as a template

Ahmad Ibrahim Ayesh[a,b,*]

[a] *Physics Department, United Arab Emirates University, Al Ain, UAE, P.O.Box 17551*

[b] *The MacDiarmid Institute of Advanced Materials and Nanotechnology, Christchurch, New Zealand*

[*] *Corresponding author: Ayesh@uaeu.ac.ae*

Abstract

Nanoclusters have special importance in nanotechnology because of their low dimensionality, which provides electronic, chemical and magnetic properties that differ from those of the equivalent bulk materials. Suitably controllable self-assembly methods are required in order to incorporate nanoclusters into useful devices.

The templated assembly method reported here was used to produce Bi nanocluster wires using silicon dioxide passivated silicon V-grooves as template elements. The inert gas aggregation method was used to produce the Bi nanoclusters from an ultra high vacuum compatible apparatus. The momentum of the deposited nanoclusters causes them to slide or bounce to the apex of the V-groove and assemble to form a conducting wire (Figure 1). Nanoscale devices can be fabricated by deposition of clusters into pre-formed electrical contact structures.

In order to characterise the assembly process V-grooves with different widths were formed on passivated Si substrates and used as templates for cluster assembly. The amount of the deposited material required to form a continuous wire was found to be a function of the V-groove width and the wire length. Two point electrical measurements were performed on the samples using Au/Ti contacts. The I(V) measurements of high resistance nanocluster wires (MΩ) showed non-linear characteristics in the voltage range between -1 and +1V. The dependence of the nanocluster wire resistance on temperature was studied in the temperature range of 4.2-300K (Figure 2). All of the measured wires showed a negative temperature coefficient of resistance. These measurements showed that the nanocluster wires formed by the template assembly method can be used for device fabrication.

Keywords: Nanotechnology; Nanocluster devices; Nanodevice.

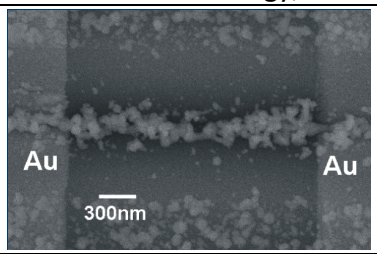


Figure 1: Bi nanocluster device assembled in the apex of the V-groove between two Au/Ti contacts.

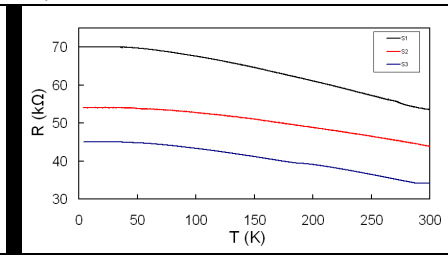


Figure 2: The temperature dependence of the resistance for three Bi nanocluster devices.

Microwave two-step sintering behavior of nano-crystalline 8YSZ powder

Mahdiar Valefi[a], Cavus Falamaki[a,b,*], Touraj Ebadzadeh[a], Ahad Fattahi[a]

[a] *Ceramics Department, Materials and Energy Research Center, P.O. Box 14155,4777, Tehran, Iran*

[b] *Chemical Engineering Department, Amirkabir University of Technology, P.O. Box 15875-4413, Tehran, Iran*

Abstract

Cubic yittria stabilized zirconia has gained extreme importance as a key material for the production of solid oxide fuel cells, oxygen sensors and oxygen separation membranes. Sintering of nano-crystalline 8YSZ (8 wt. % yittria stabilized zirconia) powders is a subtle process for the production of the latter equipment.

Generally, the main problem in sintering nano-crystalline ceramics by conventional methods is the retention of the fine structure due to the increased grain growth. Several processing methods have been used to prepare dense and fine microstructure ceramics with enhanced properties. These include application of grain growth inhibitors, two-step sintering, microwave sintering, and spark plasma sintering and hot pressing.

The present work discusses the microwave assisted densification and grain growth of nano-crystalline 8YSZ powder derived from combustion synthesis. A novel two-step microwave sintering method is disclosed. The density, microstructure and ionic conductivity of the samples produced by microwave heating and two-step microwave heating are measured and compared. It is shown that two-step sintering might result in significant grain growth inhibition and high density. However, impedance spectroscopy analysis showed that the latter compacts obtained by two-step sintering using microwave energy have a lower ionic conductivity with respect to the conventional microwave assisted sintering method.

Synthesis 4

Synthesis and luminescence characterization of $Ca_5(PO_4)_3F:Eu^{2+}$ blue nanophosphor

S.J.Dhoble[a,*], I. M. Nagpure[a], M. S. K. Khokhar[b], R. S. Kher[c]

[a] *Kamla Nehru College, Sakkardara Square, Nagpur- 440 009, India*

[b] *Department of Rural Technology, Guru Ghasidas University, Bilaspur 495 009, India*

[c] *Department of Physics, Government Science P. G. College, Bilaspur 495 006, India*

[*] *Corresponding author: sjdhoble@rediffmail.com*

Abstract

Luminescent materials were also known as nanophosphors have been extensively investigated during the last decade due to their application potential for various high performance and novel display devices [1]. The europium activated nanophosphor are used as blue component in three band fluorescent lamps [2]. In particular Eu2+ broad band emission is intense enough to find important industrial applications in the tricolor fluorescence lamps, electroluminescent lamp, display devices and LEDs. Many new physical and chemical methods of preparations have also been developed in the last onedecade, nanoparticles and nanorods (powders) of several ceramic as well as luminescent materials have been reported [3]. There are very few references are available for the synthesis of nano phosphates based materials. Heike Meyssamy et al reported the synthesis of rare doped nanophosphate by wet chemical synthesis [4].

Moreover, we are interested in the $Ca_5(PO_4)_3F$ phosphate based system for blue emitting phosphor. Eu2+ activated phosphate based nanophosphors was prepared by combustion synthesis which is reported in this paper. The PL broad band emission spectra of Eu^{2+} ion is observed at around 440nm in the blue region of the visible spectrum under the 360nm excitation. The X-ray diffraction pattern of $Ca_5(PO_4)_3F$ phosphors shows nanocrystalline nature of the prepared material. The average crystalline size of the prepared $Ca_5(PO_4)_3F$ nanophosphor was calculated from XRD line broadening using Debye-Scherrer equation was found to be 25-35nm. The PL properties of Eu^{2+} activated $Ca_5(PO_4)_3F$ nanophosphor shows the it is one of the material for lamp industry.

Keywords: luminescence, nanophoshpor, phosphate

Isolation and characterization of Magnetotactic bacteria from various parts of I.R. Iran

Farhad Farzan[a], Seyed Abbas Shojaosadati[a,*], Hossain Abdul Tehrani[b]

[a] *Biotechnology Group, Chemical Engineering Department, Tarbiat Modarres University, Tehran, Iran*

[b] *Medical Biotechnology Department, School of Medical Sciences, Tarbiat Modarres University, Tehran, Iran*

[*] *Corresponding author: shoja_sa@modares.ac.ir*

Abstract

Magnetic nanoparticles (MNPs) and more particularly magnetite (Fe_3O_4), has been widely used for biomedical applications such as cell targeting, cell separation, drug delivery and hyperthermia or in environmental sciences for metal separation from waste water. Chemical and biological techniques have been used for the synthesis of MNPs. Magnetotactic bacteria produce magnetic particles in anisotropic shapes and in defined sizes, so the properties of MNPs which are synthesizes biologically are more effective compared with chemical synthesis for biomedical uses. In this research biological techniques were used. Samples were collected from various parts of Iran including Ilam, Miankaleh and Caspian Sea. In order to isolate the magnetotactic bacteria, the samples were first enriched and then cultivated in DSM3856 medium. The isolated colonies were evaluted by using magnet and also SEM and TEM were used for further analyses of bacteria.

Keywords: Magnetotactic bacteria, Isolation, Characterization

A sol-gel derived photochromic coating containing AgCl nano particles on soda-lime glass

B. Mirfakhraei
Corresponding author: bmirfakhraei@yahoo.com

Abstract

Photochromic coatings containing silver chloride nanocrystals were formed on a sodalime glass substrate via the sol-gel process. A SiO_2 buffer layer based on tetraethoxysilane (TEOS) was coated on the substrate in order to prevent Ag ion migration into the substrate. In order to develop a photo sensitive layer, a SiO_2-gel based on tetraethoxysilane (TEOS) was doped with silver nitrate and trichloromethylsilane. Cupper nitrate was also incorporate to provide the photochromic characteristic of the layer. Effect of hydrolysis temperature and coating procedure on AgCl crystal size was investigated by X-ray diffraction, SEM and TEM. Visible transmittance of coated glass was calculated from transmission spectrum measured by spectrophotometer.

Nanocrystalline Fe_3Mo_3C powder: synthesis, microstructure and morphological aspects

Babak Mozafari[*], Shayan Farhikhteh, Esmael Salahi
Ceramic Department, Materials and Energy Research Center (MERC), Tehran, Iran
[*] Corresponding author: Babakmz@yahoo.com

Abstract

A nanocrystalline Fe_3Mo_3C powder was synthesized by mechanical alloying process. The starting materials with the molar ratio of 3Fe:3Mo:1C were milled in a planetary ball mill. In order to study the effect of ball to powder weight ratio on the morphology and micro-structural behavior of powder during mechanical alloying process two different ball to powder weight ratios were chosen (10:1, 20:1). According to X-ray diffraction analysis increasing ball to powder weight ratio promotes the Fe_3Mo_3C formation in lower milling time. For the specimen milled for 50 hours with ball to powder weight ratio 20:1, and annealed under Argon atmosphere at 1100ºC, monophase Fe_3Mo_3C was obtained. The mean crystallite size of the resulted powder was 33 nm. To study the morphology evolution and effect of ball to powder weight ratio on it, during different stages of mechanical alloying, Scanning electron microscope was used. Also the results of tap density illustrate the steps of mechanical alloying process.

Keywords: Fe_3Mo_3C, nanocrystalline, ball to powder weight ratio, microstructural evolution

Application of dispersed nano size YSZ aqueous slip in SOFC electrolytes

P. Keyvanfar
Corresponding author: pkeyvanfar@gmail.com

Abstract

The dispersion of nano size yttria stabilized zirconia (YSZ) aqueous slip is investigated. The slurry stability is achieved by utilizing a commercially available dispersant, Dolapix CE 64. Sedimentation tests and rheology measurements have been performed to investigate the suspension properties. 15 and 20 vol. % slips were prepared by dispersing the powder in water with Dolapix at pH values in a range of 8-9.5. The influences of the amount of Dolapix and pH on rheological properties of the slips were studied. The minimum viscosities slips were obtained with the addition of 0.05-0.1 wt. % Dolapix at pH 9. These slips were coated on a NiO-YSZ substrate and sintered at 1400^{o}C. The sintered density was 98% of theoretical density.

Synthesis 5

New Chemical Sol-Gel Process (CVD) Synthesis of Carbon Nanotubes with Palladium Do pant for Hydrogen Storage

A. Kazemzadeh
Materials & Energy Research Center, Tehran, P.O. Box 14155-4777- Iran
Corresponding author: Asg642001@yahoo.com

Abstract

This work deals with. Support and catalyst materials have been proved to be critical to scalable chemical vapor deposition (CVD) synthesis of carbon nanotubes. In own study, we found that porous Al_2O_3, SiO2 prepared by sol-gel process of its organosilane compound and salts was an eminent support for CVD growth of carbon nanotubes. The quality of as-grown ($SWAT_S$). On Al_2O_3, SiO2 support and Fe, MO catalyst was stable; the effect of reaction condition such as furnace temperature, flow rate, of the gas and type of catalysts and supports on the properties of as ($SWNT_S$). Products were thoroughly investigated and characterize by TEM, SEM, C-V, I-V, Band Gap, Hall effect, XRD, Raman Spectroscopy and technologies. The ultimate goal of this research is to develop a low cost, high capacity hydrogen storage material. The final product should have favorable thermodynamics and kinetic characteristics as well as stability with cycling. However simple mechanism for hydrogen uptake and release involving physisorption and chemisorptions alone account for the usual sorption of hydrogen by carbon nanotubes.

Keywords: Carbon Nanotube, CVD Synthesis and Hydrogen Storage

Optimization of Temperature Processing to Achieve High Quality Sol-Gel Derived PZT Thin Film

Sajjad Dehghani[a,*], Mohammad Hossein Sheikhi[b]

[a] *Department of electrical engineering, Tarbiat modares University, Tehran, Iran*

[b] *Department of electrical engineering, Shiraz University, Shiraz, Iran*

[*] *Corresponding author: dehghani@modares.ac.ir*

Abstract

Ferroelectric $PbZr_{1-x}Ti_xO_3$ (PZT) thin films have been extensively investigated because of their excellent piezoelectric, pyroelectric, ferroelectric, and dielectric properties. Sol–gel synthesis and spin-coating are popular routes to the formation of high quality, dense, crack-free thin films. In this work, high quality, crack-free PZT thin films have been prepared by sol-gel method via spin-coating on $Pt/Ti/SiO_2/Si$ substrate by different temperature processings. The crystallographic and morphological properties of the films have been analyzed by X-ray diffraction, and scanning electron microscopy. The electrical properties of thin films including the permittivity, loss tangent and polarization-voltage hysteresis loop were measured and compared for different films. Finally by optimizing temperature processing, highly textured and high quality films of PZT with perovskite phase were formed on $Pt/Ti/SiO_2/Si$ substrates.

Keywords: Thin film, Piezoelectric, PZT, Sol-Gel

Synthesizing nanoparticles of ZnO/SiO_2 nanocomposite using sol-gel by changing of composite parameters

H. Zare Bidaki[a], V. Ahmadi[b,*], SH. Ahmadi[c]

[a] *Department of Nanomaterial Engineering, Tarbiat Modares University, Iran*

[b] *Department of Electrical Engineering, Tarbiat Modares University, Iran*

[c] *Department of Physics, Tarbiat Modares University, Iran*

[*] *Corresponding author: v_ahmadi@modares.ac.ir*

Abstract

We synthesize nanoparticles of ZnO/SiO_2 nanocomposite by sol-gel technique where SiO_2 nanoparticles are as the matrix for the ZnO nanoparticles. X-ray diffraction, Raman effect, photoluminescence, optical transmittance, energy dispersive X-ray spectroscopy and scanning electron microscopy are used to characterize the structural and optical properties of the samples. The photoluminescence spectra of ZnO/SiO_2 (ZnO/SiO_2=1:6, molar ratio) shows that the intensity of the ultraviolet (UV) photoluminescence (348 nm) from ZnO is greatly enhanced by incorporating ZnO into the SiO_2 matrix. We investigate the effect of molecular weight of alcohol solvents on the size of nanoparticles by using different solvents, such as: ethanol, methanol, 2-propanole in the sol-gel process. The particle nucleation and growth processes of nanoparticles are varied with the reaction conditions, and also, the effect of ZnO: SiO_2 molar ratio variation on optical transmittance is investigated. It is found that the position of band edge shifts toward a shorter wavelength with the decrease of ZnO in the nanocomposite. The result of this study confirms that ZnO-based nanocomposites are very useful for applications in a variety of devices such as UV random lasers, optoelectronics integrated devices and semiconductor lasers.

Keywords: Nanostructures, Photoluminescence, ZnO nanoparticle, Nanoparticles of ZnO/SiO_2 nanocomposite

An investigation of optical and electrical properties of iron doped CdS quantum dots

M. H. Yousefi[a], S. M Taheri[a], A. A. Khosravi[b]

[a] *Nanotechnology Research Group, Faculty of Applied Sciences, Malek-Ashtar University of Technology P.O. Box 83145/115 Shahinshahr, Isfahan, Iran*

[b] *Department of Physics, Faculty of Sciences, University of Shahed, Tehran, Iran*

[*] *Corresponding author: mhyphd1@Gmail.com*

Abstract

$Cd_{1-x}SFe_x$ (x=0-0.06) semiconductor nanoparticles (Quantum Dots) have been synthesized by chemical capping method at room temperature. UV_Visible investigation exhibits a blue shift of 2.4eV to 3.46 eV for CdS quantum dots as additive concentration varies. PL spectra show an emission peak at 492nm for undoped CdS, while it is 532 nm for Fe doped CdS. However the amount of dopant does not alter the peak position. XRD studies show hexagonal structure of quantum dots with approximate size of 1.7nm. However TEM images reveal the exact size of 2 nm for CdS QDs with very good size distribution. To study the exact amount of iron incorporated in doping process AAS has been used.

Keywords: Quantum Dots, Luminescence, Capping method, Semiconducting nanoparticles

Structural and Magnetic properties of Fe_2O_3 nanoparticles obtained by ball milling

O. M. Lemine[a,*], S. Mufti[b], R. Msalam[b], M. Sajieddine[c], A. Alyemani[d], M. Bououdina[e]

[a] *College of Sciences, Imam University, Department of Physics, Riyadh , Saudi Arabia*

[b] *Radiation Technology Center, KACST, Riyadh, Saudi Arabia*

[c] *Sultan Moulay Slimane University, Laboratoire de Physique et Mécanique des Matériaux, Béni-Mellal (Morroco)*

[d] *National Nanotechnology Center, KACST, Riyadh, Saudi Arabia*

[c] *College of Science, University of Bahrain, Department of Physics, Kingdom of Bahrain*

[*] *Corresponding author: leminej@yahoo.com*

Abstract

Fe_2O_3 Nanoparticles were obtained by a mechanical alloying of micrometer-sized powder at different milling times using a vibratoy mill (SPEX 8000 mixer). Samples were characterized by X-ray powder diffraction, scanning electron microscope (SEM), FT-IR, Mössbauer spectrometry and Vibratory sample magnotometer (VSM). A qualitative and quantitative phase analyses using the Rietveld method have been performed based on the XRD data. The results show that prolongation of milling times decrease particles size, with impact on the magnetic properties. An expansion of both a and c lattices parameteres are observed.

Synthesis, Structure and Magnetic Properties of Nano-Sized MFe_2O_4 (M is a Metal) Materials

S. Arekat, A. Al-Saie, A. Jaafar, M. Bououdina*

University of Bahrain, College of Science, Department of Physics, PO Box 32038, Kingdom of Bahrain

* *Corresponding author: mboudina@sci.uob.bh*

Abstract

The synthesis of Spinel Ferrite MFe_2O_4 Materials at the nano-scale has attracted great attention in recent years due to their potential applications as high-density magnetic recording, microwave devices, magnetic fluids, etc. Mechanical alloying as a solid state process is a powerful technique and offers many possibilities for chemical alloying and microstucture modifications, in the preparation of new materials at the nano-scale with improved properties including non-equilibrium phases (supersaturated solid solutions, amorphous phases). Milling a mixture of Fe-Oxide and Metal-Oxide with various ratios under various milling conditions would lead to the formation of nanocrystalline and / or amorphous phases. Subsequent annealing at appropriate temperatures leads to the formation of a nanoscale crystalline pure MFe_2O_4 phase. XRD and Crystal structure analysis using the Rietveld method, electron microscopy (SEM, TEM, and EDS), FTIR, and magnetic measurements using VSM under various temperatures, were carried out.

Keywords: Nanoparticles; Magnetic Materials; X-ray diffraction; FTIR; SEM

Synthesis of high specific surface area of YSZ (ZrO_2-$8Y_2O_3$) nanocrystalline powder by modified Polymerized Complex Method

Shayan Farhikhteh[*], Babak Mozafari, Babak Reissi, Amir Maghsoodi Pour
Materials and Energy Research Center, Karaj, Meshkin Dasht, Iran
[*] *Corresponding author: shayan_farhikhteh@yahoo.com*

Abstract

In this study high specific surface area of Yttria-Stabilized Zirconia (ZrO_2-$8Y_2O_3$) nanocrystalline powder have been prepared through '' Modified Polymerized Complex Method (MPC) ''. Zirconium chloride, Yttrium nitrate, Citric acid and Ethylene glycol were polymerized at 80°C to produce a gel-like mass. During the thermal treatment of dried gel, nanocrystalline YSZ was formed. Thermal reactions and phase formation of dried gel were investigated through thermal analysis (DTA/TG) and X-ray diffraction (XRD) analysis respectively. Chemical bonding and thermal decomposition behavior of dried gel was investigated by FTIR analysis. During decomposition, the nature of the bonding between carboxylate groups and the cations changed from unidentate to bridging at 370˚C and from bridging to ionic at 470˚C. Morphology of powder calcined at 650°C was analyzed by scanning electron microscope (SEM). The resulted powder displayed a porous and friable structure which seems to result from a large amount of gases released during charring. The used method led to the formation of nanocrystalline powder with 149m^2/gr surface area which was more than six times higher than the specific surface area of powders synthesized under acidic condition.

Keywords: Pechini Type Method; YSZ; Nanocrystals; Specific Surface Area

Synthesis 6

Synthesis of nanocrystalline YSZ (ZrO_2-$8Y_2O_3$) powder by polymerized complex method

Shayan Farhikhteh*, Babak Mozafari, Babak Reissi, Amir Maghsoodi Pour
Materials and Energy Research Center, Karaj, Meshkin Dasht, Iran
** Corresponding author: shayan_farhikhteh@yahoo.com*

Abstract

Nanocrystalline powders of Yttria-Stabilized Zirconia (ZrO_2-$8Y_2O_3$) have been synthesized by ''Polymerized Complex Method (PC)''. Zirconium chloride, Yttrium nitrate, Citric acid and Ethylene glycol were heated at 80°C to produce a gel-like mass in which metallic ions were uniformly distributed. The obtained mass was dries at 120°C. During the thermal treatment of dried gel, nanocrystalline powder was formed. Thermal reactions and crystalline phase formation of the dried gel were investigated through thermal analysis and X-ray diffraction analysis respectively. The peaks corresponding to the loss of bound water and removal of excessive ethylene glycol, decomposition of organic materials and crystalline phase formation were identified. Chemical bonding of the dried gel was investigated by Fourier transform infrared spectroscopy analysis and the bands related to carboxylate stretching modes, COH groups and metal oxygen stretching modes were observed. Morphology of powder calcined at 650°C was analyzed by scanning electron microscope. YSZ powder displayed a compact and strongly agglomerated microstructure. The mean grain size estimated from SEM micrographs was around 90-100nm. Yttria-Stabilized Zirconia powders with the mean crystallite size of 6nm were prepared successfully by this method.

Keywords: Polymerized Complex Method; YSZ; Nanocrystals

A Versatile Bottom up Approach for the Synthesis of Tin Oxide Nanoparticles and their Potential

M. A. Shah
EM Laboratory, Department of Physics, National Institute of Technology, Hazratbal Srinagar-190006. India
Corresponding author: Shah11nit@gmail.com

Abstract

Functional oxides are presently much investigated for their potential applications in various areas. Tin oxide appears particularly interesting when grown in nanometer range. A versatile and an economic technique has been developed for the synthesis of tin oxide nanoparticles at very low temperature, which does not require any substrate or surfactant. The technique is based on a simple reaction of tin and water at low temperature. The water is regarded as benign solvent and we believe that the nanostructures so produced are biocompatible. The formation of nanoparticles by the reaction of metals with water is suggested to occur due of decomposition of water by the metal giving hydrogen. The nanoparticles have diameters in the range of 50-300nm and an average diameter of 150nm. This synthetic technique has the following advantages: Firstly, it is one step synthesis approach, making it easy to control the growth kinetics. Secondly, the synthesis needs no sophisticated equipments since it is conducted at low temperature of 200oC under normal atmosphere. Thirdly, the clean surfaces of the as-synthesized nanostructures can be readily functionalized for various applications since there is neither a capping reagent nor a substrate. Forth, the approach is non toxic without producing hazardous waste. Therefore, the technique could be extended and expanded to provide a general simple and convenient strategy for the synthesis of nanostructures of other functional materials with important scientific and technological applications. The relative studies are in process and will be reported in forth coming publications. Compared with other methods, the present method is simple, soft, inexpensive and environmentally benign. Promises and potential of nanostructures are discussed in detail.

Keywords: Simple Synthesis, Hydrogen Evolution Reaction, Nanostructures, Promises and potential are discussed in detail

Optimization of PEGylation of BSA nanoparticles

H. Kouchakzadeh, S. A. Shojaosadati*

Biotechnology Group, Chemical Engineering Department, Tarbiat Modares University, Tehran, Iran

* *Corresponding author: shoja_sa@modares.ac.ir*

Abstract

The covalent linking of PEG strands (PEGylation) is a well known technique used to improve pharmaceutical properties of bioactive proteins and peptides. This polymer is nontoxic, nonimmunogenic, non-antigenic, highly soluble in water and FDA approved. In this research, Bovine Serum Albumin (BSA) nanoparticles were produced and the effect of PEG concentration, temperature, time and pH on PEGylation process of BSA nanoparticles was investigated using full factorial experimental design. The concentration of albumin nanoparticles was constant in all experiments at 5mg/ml. Analysis of the experimental data using Minitab software version 14 showed that the most effective factor is PEG concentration.

Keywords: BSA nanoparticles, PEGylation, Free amino groups

Sintering and grain growth in nanocrystalline Y_2O_3 stabilized zirconia

Mehdi Mazaheri[a], Zohreh Razavi Hesabi[b], Farhad Golestani-Fard[c,*]

[a] *Materials and Energy Research Center, P.O. Box 14155-4777, Tehran, Iran*

[b] *Materials and Energy Research Center, P.O. Box 14155-4777, Tehran, Iran*

[c] *Department of Materials and Metallurgical Engineering, Iran University of Science and Technology, Narmak, Tehran 16846-13114, Iran*

[*] *Corresponding author: golestanifard@iust.ac.ir*

Abstract

Nano yttria stabilized zirconia (YSZ) is of interest due to its potential applications in electroceramics as well as mechanical parts. There has been little information on sintering and microstructureal evolution of ceramic bodies based on YSZ nanopowders. The strong tendency of agglomeration and grain growth in primary nano powders creates a major problem for production of suitable bodies.

In this work, the sintering behavior of zirconia nanopowder stabilized with 3 and 8 mol% yttria was investigated. To suppress the accelerated grain growth at the final stage of sintering, two step sintering method was employed. A significant reduction in final grain size of nearly-full dense structures was obtained. While the grain size of conventionally sintered 8 mol% yttria stabilized zirconia was > 2 μm, two-step sintering yielded a finer structure with a grain size < 300 nm. It was also demonstrated that the slip cast bodies showed interesting results in terms of mechanical and microstructural features. The comparison of shape forming methods and sintering routs are explained with emphasis on potential applications.

Keywords: Nanocrystalline; Two-step sintering; Grain growth; Zirconia

Synthesis of Iron-Based Nanoparticles for Bio-Medical Applications

S. Rashdan[a], M. Bououdina[b,*] , A. Al-Saie[b], H. E. Ghanem[c], H. Al-Sayed[c], A. Bin-Thani[c]

University of Bahrain, College of Science, PO Box 32038, Kingdom of Bahrain

[a] Department of Chemistry

[b] Department of Physics

[c] Department of Biology

[*] Corresponding author: mboudina@sci.uob.bh

Abstract

Iron oxide nanoparticles have attracted much research interest over the recent years because of their great potential for various biomedical applications such as cell separation and medical drug targeting. In drug targeting, for example, the superparamagnetic nanoparticles consist of iron oxide core and functionalized organosilanes on the surface that can be attached to specific cell (cancer cells) and targeted through external magnets. The iron oxide nanoparticles have been synthesized via a wide variety of methods and by using different surfactant to control the size of the particles. The synthesized samples have been characterized by X-ray diffraction, FTIR, SEM and magnetic measurements. The results will be discussed in terms of the effect of synthesis method and raw materials on the formation of iron oxides, purity, crystallite size and magnetic properties.

Keywords: Nanoparticles; Iron Oxides; Co-Precipitation, Crystallite size, Magnetic Properties

Bio-nanotechnology 1

Sensitive Purification of minute Amounts of Messenger RNA Using nano-magnetic beads

Adeeb M. Al-Zoubi[a,*], Matthew Alexander[b], Bellur Prabhakar[c]

[a] *Department of Biotechnology and Genetic Engineering, College of Science, Philadelphia University, Amman, Jordan*

[b] *Beckman Coulter, Fullerton, CA, USA*

[c] *Department of Microbiology and Immunology, College of Medicine, the University of Illinois at Chicago, IL, USA*

[*] *Corresponding author: aalzoubi@gmail.com*

Abstract

In eukaryotic organisms, gene expression is achieved through two steps: transcription of DNA into the single-stranded messenger RNA (mRNA), and then translation, where the genetic code on mRNA is used as a template to make a specific protein with a precise function in life. Through simultaneous analysis of large numbers of mRNA transcripts, researchers can have extensive insights into which genes are activated to make specific proteins, without having the complexity to deal with each protein individually. However, due to the single strandedness of mRNA, it is very hard to work with; mRNA isolation can be tricky if caution is not followed. Sometimes, the amount of a specific mRNA transcript is prohibitively very low, which makes it hard to be isolated and analyzed.

Prior to being used for translation, the newly transcribed eukaryotic mRNAs (pre-mRNA transcripts) have to undergo three major modifications that lead to the maturation of mRNA: capping, splicing, and poly-adenylation (pA). The presence of a given pre-mRNA does not necessarily mean the corresponding protein will be synthesized, because a big percentage of pre-mRNAs get destroyed within the nucleus before or during modification. Therefore, to assess protein expression, a novel method was developed to isolate pA-mRNA transcripts through the use of poly-dT conjugated with beads of different types. The most commonly used poly-dT beads are agarose poly-dT beads. Since pA forms Hydrogen bonds with poly-dT, this binding can be exploited to pull down the mRNA transcript by centrifugation using the heavy weight of the agarose bead. However, the agarose bead are very large compared to the mRNA transcripts, require long incubation time with cell lysates to bind to the pA-mRNA, and they have big tendency to bind biomolecules non-specifically. On the other hand, a newer method for isolating mature mRNA utilizes extremely small magnetic beads. This method employs nano magnetic beads, 30-50 nanometer in diameter, conjugated to poly-dT. Using nano-size magnetic beads, fishing for mature mRNA transcripts has been shown to be more efficient and takes much less time to achieve. After adding the poly-dT magnetic beads to the cell lysate, further incubation is not necessary, and the lysate is allowed to pass through a column packed with iron spheres placed in a magnetic field.

Bioconjugated nanoparticle detection of PPR virus

F. Golchinfar, R. Madani, T. Emami

Biotechnology Dept. of Razi Vaccine and Serum Research Institute, P. O. Box: 11365/1558

Abstract

The integration of nanotechnology with biology has produced major advances in molecular diagnostics, therapeutics, and bioengineering. Recent advances have led to the development of functionalized nanoparticles (NPs) that are covalently linked to biological molecules such as antibodies, peptides, proteins, and nucleic acids. These functionalized NPs allow for development of novel diagnostic tools and methods, particularly for pathogens, as rapid and sensitive diagnostics are essential for defining the emergence of infection, determining the period that preventive measures should be applied, for evaluating drug and vaccine efficacy, and for controlling epidemics. In this study, we show that functionalized NPs conjugated to monoclonal antibodies can be used to rapidly and specifically detect respiratory virus. These results suggest that functionalized NPs can provide direct, rapid, and sensitive detection of viruses and thereby bridge the gap between current cumbersome virus detection assays and the burgeoning need for more rapid and sensitive detection of viral agents such as Peste des petits ruminants (PPR).

Keywords: Bioconjugated, PPR, Monoclonal, Nanoparticle

Nanobiotechnology to investigate the role of substance P activation in the pathogenesis of Alzheimer's disease

Abdulmonem Abdulsalam Al-Hayani
Department of Anatomy, Faculty of Medicine, King Abdulaziz University, PO Box 1931, Jeddah 21441, Jeddah, Saudi Arabia
Corresponding author: hayani30@hotmil.com

Abstract

Alzheimer's disease can be identified by two classical lesions, senile plaques composed of β-amyloid and neurofibrillary tangles composed of tau. Both β-amyloid and tau have been proposed to cause the neuronal degeneration observed during Alzheimer's disease. This project addresses one specific hypothesis regarding the mechanism by which β-amyloid and substance P may affect neuronal function.

Using the nanobiotechnology technique, extracellular field recordings, it was found that substance P had no effect on excitatory neurotransmission, failing to increase or decrease the amplitude of field EPSPs recorded from the CA1 region. However, paired pulse stimulation and the recording of population spikes revealed that substance P could increase the amplitude of the second population spike, perhaps reflecting a reduction in inhibitory feedback inhibition known to occur within the hippocampus. The use of various tachykinin receptor agonists revealed that only NK-1 receptor agonists could significantly increase the amplitude of the second population spike. Further to this, the NK-1 receptor antagonist SR140333 blocked the action of substance P. Therefore it was concluded that substance P acting via the NK-1 receptor could decrease the degree of paired pulse depression observed, thereby increasing the amplitude of the second population spike.

The current study has proven a significant role for nanobiotechnology to investigate the pathogenesis of Alzheimer's disease. These results will open avenues for future therapeutic targets to prevent and/or to delay the incidence of Alzheimer's disease.

Keywords: Alzheimer's disease; substance P; extracellular field recordings; Whole cell patch clamping; β-amyloid

Nanoscaffolds for advancing tissue engineering

Nureddin Ashammakhi
Institute for Science & Technology in Medicine, Keele University, Keele university, UK

Abstract

Electrospinning is a versatile technique that enables the development of nanofiber-based scaffolds, from a variety of polymers that may have drug-release properties. Using nanofibers, it is now possible to produce biomimetic scaffolds that can mimic extracellular matrix (ECM) for tissue engineering. Interestingly, *n*-fibers can guide cell growth along their direction. Combining factors like fiber diameter, alignment and chemicals offers new ways to control tissue engineering. *In vivo* evaluation of nanomats included their degradation, tissue reactions and engineering of specific tissues. New advances made so far in *e*-spinning *n*-fibers especially in controlled drug release that increase the potential of these *nanobiomaterials*. Nevertheless, there is already at least one product based on *e*-spun n-fibers with drug release properties being in phase III clinical trail, for wound dressing. Hopefully, clinical applications in tissue engineering will follow to enhance the success of regenerative therapies.

A new fullerene-based ^{25}Mg-exchanging nanocationite for correction of doxorubicin-induced ATP depletion in rat myocardiocytes

S. V. S. Boushehri[a,*], S. M. Rezayat[a], S. Sarkar[b], D. A. Kuznetsov[c]

[a] *Department of Medical Nanotechnology, School of Advance Technology in Medical Sciences, Tehran University of Medical Sciences, P.O. Box: 13145-784, Tehran, I.R. Iran*

[b] *Research Center for Science and Technology In Medicine (RCSTIM), Tehran University of Medical Sciences, P.O. Box: 14185-615, Tehran, I.R. Iran*

[c] *N.N. Semenov Institute for Chemical Physics, Russian Academy of Sciences, Moscow, Russian Federation*

[*] *Corresponing author: vshetab@razi.tums.ac.ir*

Abstract

It has been recently found that the magnesium-dependent ATP production is a nuclear spin control process (1). It means that, magnetic isotope effect of $^{25}Mg^{2+}$, *the only magnetic magnesium isotope* (+5/2 nuclear spin, 0.85 Bohr magneton magnetic moment, 10% natural abundance), is an essential element in the magnesium-dependent ATP production processes. Both substrate and oxidative phosphorylation pathways, as Mg^{2+}-dependent processes, might be activated up to 2.5-fold more efficiently by milimolars of $^{25}Mg^{2+}$ as compared to non-magnetic $^{24}Mg^{2+}$ (0 spin, 78% natural abundance) and $^{26}Mg^{2+}$ (0 spin, 11% natural abundance) isotopes (1).

Recently, a low toxic (LD_{50}=896 mg/kg, i.v., rats), amphiphilic (430 mg/ml water, pH 7.40), membranotropic and cluster forming 1.8-2.0 nm fullerene-C_{60} based nanoparticles has been designed for correction of hypoxia-induced ATP depletion (2). This product, possessing marked cationite properties, is an iron containing porphyrin monoadduct of a classical fullerene C_{60}, *buckminster-fullerene (C_{60})-2-(butadiene-1-yl)-tetera(o-γ-aminobutyryl-o-phtalyl)ferroporphyrin*. Hereafter, we refer it to "Porphylleren-MC16" or, in brief, PMC16 (2).

This smart *nanocationite* with membranotropic properties releases the overactivating cations *only* in response to the intracellular acidosis (2).

Doxorubicin (DXR), a widely used anticancer drug, induces cardiotoxicity by ATP depletion and cellular acidosis (3). Thus, it was decided to use ^{25}Mg-carrying PMC16 nanoparticles (^{25}Mg- PMC16) for correction of DXR-induced ATP depletion in myocardial cells.

The effect of fine Zeolite powder on the stability of vitamin E

Mehdi Rahimi[a,*], Aliasghar Behnamghader[b], Hamid Mobedi[c], Alireza Nateghi[c]

[a] *Department of Biomedical engineering, Science & Research Branch, Islamic Azad University, P.O.Box:14665-1445, Tehran, Iran*

[b] *Material & Energy Research Center, P.O. Box: 14155-4777, Tehran, Iran*

[c] *Iran Polymer & Petrochemical Institute, Pazhohesh Blv, Tehran, Iran*

[*] *Corresponding author: Rahimi@anzymite.com*

Abstract

Incorporation of drugs into porous inorganic carriers such as Zeolite with the purpose of delivering the active compound at a controlled rate is a major issue of interest for both materials science and medicine. The purpose of this research was to study the effect of fine Zeolite powder with a size lower than 50 µm on the stability of vitamin E. The powder emanating from natural Iranian Zeolite was first plunged in a saturated solution of vitamin E. The solutions were then taken in laboratory condition at room temperature for 2 hours, 3 and 10 days. Zeolite type, chemical and morphological aspects were studied using SEM, XRD and XRF experiments. HPLC experiment was used to investigate the extracted vitamin E from Zeolite powder. The XRD analysis revealed the powder used in this work composed of a Clinoptilolite type of Zeolite. SEM images showed the particles were porous with a pore size of lower than 5 µm. Based on the results obtained from HPLC experiments, Zeolite powder enhanced the stability of vitamin. It seems the pores have played an influential role in the increasing of extracted vitamin. The extracted vitamin after 3 and 10 days in Zeolite-contained samples were found to be 2% and 14% higher than that in controlled sample. The extracted vitamin decreased more with the holding time in the controlled sample compared to Zeolite-contained sample. This enhanced stability can be attributed to the porosity of Zeolite powder.

Keywords: Natural Zeolites, Clinoptilolite, vitamin E, stability, HPLC

Bio-nanotechnology 2

Magnetic Purification of CD133+ Pluripotent Stem Cells by Nano Particles for Treatment of Spinal Cord Injuries

Adeeb Al-Zoubi[a,*], Mohammed Jamoos[b], Ziad Al-Zoubi[c]

[a] College of Science, Philadelphia University, Amman, Jordan

b College of Medicine, Jordan University of Science and technology, Irbid, Jordan

[c] King Abdullah University Hospital, Irbid, Jordan

[*] Corresponding author: aalzoubi@gmail.com

Abstract

The spinal cord is made up of highly elaborate and delicate networks of neurons and supporting glial cells. Injuries to the area of the vertebral column may affect the underlying spinal cord. Injuries to the spinal cord can lead to loss of neuronal functions below the site of injury. As a result, the passage of messages from and to the brain is interrupted, and people can lose sensation or the ability to move their limbs. Injured neurons cannot regenerate themselves leaving their chain of communication from the brain to the muscles permanently interrupted. Permanent, complete or partial, loss of functions depends on the severity and type of the injury imposed on the spinal cord, and also on the quality of medical attention the patient received immediately after the injury. Currently, treatments of spinal cord injuries are limited to physical therapy and preventing further damage to the cord by fixation of the vertebral column and other means of support.

Stem cells are immortal cells that have the potential to differentiate into other cell types and generate mature cells with specialized functions of a particular tissue. The importance of stem cells lies in their high curative potential in regenerative medicine. Stem cells have been widely utilized in the treatment of many devastating diseases. Use of various types of stem cells for treatment of neurological disorders is currently under investigation at many centers worldwide. Identification of the stem cell population appropriate for a specific disease is of critical importance to their curative potential. Equally important is the purification process of stem cells prior to implantation.

The effect of the mechanical activation on the size reduction of the crystalline acetaminophen drug particles

E. Biazar[a,*], A. BeitoLLAHI[b], T. Forati[a], Ntentopoulou[c], M. Ardeshir[a]

[a] *Biomaterial Department, Islamic Azad University- Science and Research Branch, Tehran, ZIPcode: 1477893855 , Iran*

[b] *Material Group, Iran University of Science and Technology, Tehran Tehran, ZIPcode: 16846 , Iran*

[c] *Department of chemical engineeringt, National Technical University of Athene, Athene, ZIPcode: 15772 , Greece*

[*] *Corresponding author: kia_esm@yahoo.com*

Abstract

The particle size decrease may offer new properties to the drugs. In this study, we investigated the size reduction influence of the acetaminophen ($C_8H_9O_2N$) particles by mechanical activation using a dry ball mill. Then, the activated samples with the average size of 1 µm were investigated in different time periods with the IR, ICP, AFM and XRD methods. The results of the IR and XRD images showed no changes in the drug structure after the mechanical activation of all samples. With the half high peak from XRD and the Scherer equation, the crystallites size of the activated samples illustrated that the AFM images were in a good agreement with the Scherer equation. According to the peaks of the AFM images, the maximum average size of the particles in 30 h of activation was 24 nm with a uniformity distribution of the particles. The ICP analysis demonstrated the impurity of the tungsten carbide particles from the separation, after the activation, and the ball and jar impact to the powder sample with the most reduction size (30 h) 0.0001 g/g.

Keywords: Acetaminophen powders – mechanical activation, structure investigation, nano particles, ball mill

Design of Intelligent and Nano – grafted substrate by electron beem Treatment

Mahmood Ardeshir[a], A. Behnamghader[b], M.Khorasani[c], E. Biazar[a], M.Ghoran Nevis[d], Sh. Shahidi[d], M. Khaksar[d]

[a] *Department of Biomedical Engineering (biomaterial), Biomedical Engineering Faculty, Islamic Azad University, Science and research Branch, Tehran, Iran*

[b] *Materials and Energy Research Center, P.O. Box 1455-4777, Tehran, Iran*

[c] *Assistant Professor of polymer Research Center, Tehran, Iran*

[d] *Plasma research center of Islamic Azad University, Science and research Branch, Tehran, Iran*

Abstract

Responsive biomaterial surfaces were fabricated by grafting stimuli-responsive polymersonto polystyrene (PS) via electron beem Treatment. They have potential uses in cell adhesion/detachment control, tissue engineering, medical device, drug delivery, bioreactor, bioseparation, and responsive clothing [1, 2].

Size Evaluation of Lymph Node is protocol Dependence in MRI Using Ultrasmall Superparamagnetic Iron Oxide Nanoparticles

M.A. Oghabian[a,b,*], N. Gharehaghaji[a], S. Sarkar[a, b], R. Faridi Majidi[b], H. Ghanaati, A. Beitollahi[b]

[a] *Department of Medical Physics & Biomedical Engineering, Medical Sciences/Tehran University, Tehran, Iran*

[b] *Research Center for Science and Technology in Medicine, Emam Hospital, Tehran, Iran*

[*] *Corresponding author: Oghabian@sina.tums.ac.ir*

Abstract

Ultrasmall superparamagnetic iron oxide (USPIO) nanoparticles have a great potential to detect lymph nodes and their metastases. These nanoparticles are uptaken by macrophages in normal lymph nodes and produce susceptibility artifact. No nanoparticles uptake is seen in metastatic nodes but these regions may be missed by susceptibility artifact, obtained in surrounding area. The size of susceptibility artifact depends on the type of MRI protocols and their imaging parameters. Accordingly, the study of protocol's effects on artifact size and problems for detection of lymph nodes are essential.

In this study, USPIO nanoparticles were used as MRI contrast agent and their produced susceptibility artifact size in axillary lymph nodes were measured with various MRI protocols. For this purpose in vivo studies were performed in rats using subcutaneously injection of 20 nm dextran coated iron oxide nanoparticles. MRI T1 and T2 weighted images were obtained with a 1.5 T MRI system before and 6 hrs after nanoparticles injection using Spin Echo (SE) and Gradient Echo (GRE) pulse sequences.

The axillary lymph nodes artifact sizes produced by these protocols were determined applying registration and subtraction methods. Comparing the anatomical delineation obtained by SE methods with the artifact sizes found in GRE pulse sequences, the size differences and various physical and physiological parameters effecting susceptibility artifact extension in GRE pulse sequences was determined. The parameter setting and fundamental considerations for an optimum imaging method is recommended.

Bio-nanotechnology 3

Nanorobotic chemical communication technique for cancer therapy

Aso Shojaie[a], Mohsen Safaienezhad[b]

[a] *Technology administrator, Shahed Smart School, Sanandaj, Kurdistan, Iran*

[b] *IT Manager, Social Security Organization (SSO), Sanandaj, Kurdistan, Iran*

Abstract

This work presents chemical communication techniques for nanorobots foraging in fluid environments relevant for medical applications. Unlike larger robots, viscous forces and rapid diffusion dominate their behaviors. Examples range from modified microorganisms to nanorobots using ongoing developments in molecular computation, sensors and motors. The nanorobots use an innovative methodology to achieve decentralized control for a distributed collective action in the combat of cancer. The microscopic devices moving with the fluid flow in small blood vessels can detect chemicals released by tissues in response to localized injury or infection. We find the devices can readily discriminate a single cell-sized chemical source from the background chemical concentration, providing high-resolution sensing in both time and space. By contrast, such a source would be difficult to distinguish from background when diluted throughout the blood volume as obtained with a blood sample.

A communication approach is described in the context of recognizing a single tumor cell in a small venule as a target for medical treatment. Thus, a higher gradient of signal intensity of E-cadherin is used as chemical parameter identification in guiding nanorobots to identify malignant tissues.

A nanorobot can effectively use chemical communication to improve intervention time to identify tumor cells. The multi agent control simulations are performed using SesAm and NetLogo software.

Keywords: engineering, cancer, control systems, E-cadherin signal, endothelial cell, nanomechatronics, nanomedicine, nanorobots, nanotechnology, transducers

Purification of nanoparticle bioproduct in integrated processes: Plasmid DNA separation and recovery

Melika Ebrahimpour, Mohsen Jahanshahi[*], Ghasem Najafpour, Maryam Khavarpour
Nanobiotechnology Reserch lab, Faculty of chemical Engineering, Babol University of Technology, Babol, Iran
[*] *Corresponding author: Mjahan@nit.ac.ir*

Abstract

Large scale manufacturing of gene vectors such as plasmid DNA is an important issue in gene therapy .pharmaceutical-grade plasmid DNA for use in vaccines requires the development of reproducible and scaleable down stream processes. The aim of this study is to investigation and compassion of pDNA separation by aqueous two phase system and anion-exchange chromatography as popular techniques in plasmid DNA purification. in this work anion exchange chromatography carried out in column with 1.3 cm diameter that filled with 8 ml streamline DEAE and polymer-salt system (ATPS) consisted of polyethylenglycol(PEG300)-K_2HPO_4 was used for the purification of plasmid DNA vectors. All experiments have been done in room temperature. Results show that 88% of pDNA nanoparticle purified by expanded bed chromatography in contrast with 84% recovery of pDNA nanoparticle in top phase of aqueous two phase system.

Keywords: Expanded bed adsorption, aqueous two-phase system, plasmid DNA nanoparticle, purification

Application of Gold Nanoparticles to Avoid Diffusing of Avian Influenza Conserve Peptides from PVDF Membrane

T. Emami[a,b,*], R. Madani[a], S. M. Rezayat[b], F. Golchinfar[a]

[a] *Biotechnology Dept. of Razi Vaccine and Serum Research Institute, Tehran, Iran*

[b] *School of Advance Technology in Medical Sciences, Medical Nanotechnology Dept. Tehran University of Medical Sciences, Tehran, Iran*

[*] *Corresponding author: tara.emami@gmail.com*

Abstract

To detect antibodies in infected poultries, we chose some conserve peptides of the NS1 protein of influenza virus. These peptides with the molecular weight of 1686 Da and 1484 Da during transferring from SDS-PAGE gel to PVDF membrane will be diffused.

To avoid this problem we use gold nanoparticles with 5nm in diameter to cover the PVDF membrane. These nanoparticles will react with the functional groups in peptides and keep them in the membrane. As a result we could detect antibodies in poultries' serum against NS1 peptides to prove the disease.

Removing of Zinc by Carbon Nanotube

O. Moradi[a,*], M. R. Sohrabi[b], M. R. Alahgholi Ghasri[c], V. Haddadi[d]

[a] *Department of Chemistry, Islamic Azad University, Shahriyar-shaher-e- Gods- Branch, Tehran, IRAN*

[b] *Department of Chemistry, Islamic Azad University, Nourth Theran Branch, Tehran, IRAN*

[c] *Department of Chemistry, Islamic Azad University, Shahr-e-rey Branch, Tehran, Iran.*

[c] *Islamic Azad University, Eslamshahr Branch, Tehran, IRAN*

[*] *Corresponding author: Moradi@ureach.com*

Abstract

A carbon nanotube is the best material for removing toxic ions from waste water. In this research, we used carbon nanotube for removing of Zinc ions. Because carbon nanotube show that capability for adsorption of ions.

For determination concentration of zinc on carbon nanotube, we used Atomic Absorption Spectroscopy (AAS). The adsorption isotherms are well described by Langmuir models. Our study is showed, carbon nanotube can be good removing zinc ions from water solution and used in environmental protection.

Keywords: carbon nanotube; Zinc ions; adsorption isotherms; Langmuir models

Liver toxicity effect of normal and reduced size (< 100 nm) acetaminophen crystallites on rats

Esmaeil Biazar[a,*], Ali Beitollahi[b], Tahmine Forati[a], Ntentopoulou[c], Mahmoud Ardeshir[a], Mehdi Rezayat[d], Mohammad Hosseinalipour[b]

[a] Biomaterial Department, Biomedical Engineering Faculty, Islamic Azad University-Science and Research Branch , Tehran, Iran

[b] Material Group, Material Engineering Faculty, Iran University of Science and Technology, Tehran, Iran

[c] Department of Chemical Engineering, National Technical University of Athens (N.T.U.A), Athens, Greece

[d] Pharmacology Department, Tehran University of Medical Sciences, Tehran University, Tehran, Iran

[*] Corresponding author: kia_esm@yahoo.com

Abstract

The particle size decrease may give drugs new properties. In this article, we investigated the size reduction influence of the acetaminophen particles with overdose injections to rat livers intravenously. For this purpose, two series of acetaminophen samples were prepared; i) normal samples with the average size of 1 micrometer and ii) reduced size samples prepared with the mechanically activated method and ball mill with the average size of 24 nm. The liver toxicity of rats was pathologically measured after 48 h of injection. The pathological results exhibited that the necrosis effects, especially the confluent necrosis, in the central part of the lobule is less for the reduced size acetaminophen samples compared with the normal samples. Also the liver toxicity of two groups of rats was enzymatically measured after 48 h of injection. The transferase enzymes that could be used for this measurement were SGOP, SGPT (serum glutamate pyruvate transaminase) and ALP. According to the statistics, deriving from the calculations after the injections, it was revealed that no change was observed in the ALP and SGOP delivery as well as in the liver toxicity caused by the powder samples. However, significant change was noticed in the SGPT delivery and the liver toxicity. The liver toxicity was diminished with the injections of the reduced size acetaminophen samples in comparison with the toxicity of the normal samples.

Keywords: Acetaminophen, Reduction, Pathological investigation, enzymatical investigation, Liver toxicity

Bio-nanotechnology 4

Magnetic Purification of Breast Cancer-Specific Immune Cells by Super para-Magnetic Nano Particles

Adeeb M. Al-Zoubi[a], Rahaf Al-Zoubi[b], Mohammed El-Khateeb[c]

[a] *Department of Biotechnology and Genetic Engineering, College of Science, Philadelphia University, Amman Jordan*

[b] *Department of Applied biological sciences, College of Sciences and Arts, Jordan University of Science and Technology, Irbid, Jordan*

[c] *College of Medicine, The University of Jordan, Amman, Jordan*

[*] *Corresponding author: aalzoubi@gmail.com*

Abstract

Failure of immune surveillance against cancer is a major cause of cancer development. Several studies have shown that breast cancer patients possess specific populations of lymphocytes that are capable of attacking their breast cancer cells. Pro-inflammatory cytokines, such as Tumor Necrosis Factor-Alpha (TNF-a), that is secreted by breast tumor-infiltrating lymphocytes (TILs) play vital roles in the immune response against breast cancer. On the other hand, tumor cells have been shown to develop various immune evasion mechanisms, including the down-regulation of anti-tumor immunity. In this study, we aimed at stimulating, purifying, and analyzing specific immune cells (CD8+ T lymphocytes) that secrete TNF-alpha in response to MCF7 (a breast cancer cell line). We utilized a novel method to magnetically purify anti-breast cancer immune cells that can be used in anti-cancer immune therapy. We used a unique system that consists of two steps. We first employed bi-specific monoclonal antibodies to catch white blood cells (WBCs) that secrete TNF-a; then, we added Dextran-coated Ferric Oxide nano particles conjugated to anti-TNF-a antibody that recognizes WBCs that secrete TNF-a. Our results show that, when incubating WBCs with MCF7 cells, the numbers of TNF-a secreting WBCs were up to 15 times higher (1.54% TNF-a secreting cells out of all immune cells) compared to WBC controls (0.11 %), as revealed by flow cytometry analyses. However, the percentage of MCF7-activated WBCs that secrete TNF-a remains low and unrealistic for therapeutic purposes. Utilizing the magnetic purification of MCF7-stimulated, TNF-a secreting WBCs, allowed us to increase the percentage of effector WBCs up to 93%. When we re-incubated the magnetically purified or unpurified WBCs with MCF7 cancer cells, magnified killing of MCF7 cells was observed with purified WBCs compared with unpurified populations. Together, these results demonstrate the importance of purifying the anti-cancer effector population of WBCs in order to get significant killing of cancer cells, and the potential role for these non-toxic bio-degradable super para-magnetic nano beads for anti-tumor immunity to breast cancer.

Purification and Characterization of PMC16 Nanoparticles from Rat Heart Mitochondria

S. V. Shetab Boushehri[a,*], B. Salmanian[a], A. Omidvari[a], S. Esmaili[a], S. Tarighat[a], S. M. Rezayat[a], S. Sarkar[b], D. A. Kuznetsov[c]

[a] *Department of Medical Nanotechnology, School of Advance Technology in Medical Sciences, Tehran University of Medical Sciences, P.O. Box: 13145-784, Tehran, I.R. Iran*

[b] *Research Center for Science and Technology In Medicine (RCSTIM), Tehran University of Medical Sciences, P.O. Box: 14185-615, Tehran, I.R. Iran*

[c] *N.N. Semenov Institute for Chemical Physics, Russian Academy of Sciences, Moscow, Russian Federation*

[*] *Corresponding author: vshetab@razi.tums.ac.ir*

Abstract

Up to recently, a not-too-long list of the mitochondrial porphyrin-binding proteins (PBP) was strictly limited to well known heme-containing molecules like cytochromes or peroxidases [1]. In external membrane of mammalian mitochondria, however, some minor group of proteins with a marked capability for selective binding of porphyrin K and its derivatives but with no direct link to either heme or any other porphyrin in situ has been found lately [2]. Both functional role and structural peculiarities of these specific membrane proteins remains obscure which requires a reliable method to isolate/purify these unique compounds for their further study.

The porphyrin – engaging ligands look suitable for affinity chromatography of PBP and related compounds. It is not easy, nonetheless, to reach a perfect protein – ligand coupling as long as the whole stationary phase "molecular architecture" does not allow to make it stoichiometrically (nanotopologically) correct. Due to this, a number of technical problems are found to be the hard obstacles on a way to the PBP affinity chromatography developments [3].

To solve these problems, we have proposed an affinity chromatography technique based on application of a new stationary phase possessing the porphyrin domain as a ligand attached to the complex epoxy [cyclohecyl] C60-fullerene spacer immobilized firmly on an agarose gel matrix. In the best of our knowledge, this is the first report ever on the fullerene nanostructure use to optimize a protein-porphyrin recognition in affinity coupling.

Preventive effect of ^{25}Mg-PMC16 nanoparticles on cytotoxicities of energy metabolism inhibitors in isolated lymphocytes of rat blood

S. V. Boushehri[a,*], S. Amiri[a], S. M. Rezayat[a], S. Sarkar[b], J. Esmaeili[c], D. A. Kuznetsov[d]

[a] Department of Medical Nanotechnology, School of Advance Technology in Medical Sciences, Tehran University of Medical Sciences, P.O. Box: 13145-784, Tehran, I.R. Iran

[b] Research Center for Science and Technology In Medicine (RCSTIM), Tehran University of Medical, Sciences, P.O. Box: 14185-615, Tehran, I.R. Iran

[c] Department of Pharmacology, School of Medicine, Tehran University of Medical Sciences, P.O. Box: 13145-784, Tehran, I.R. Iran

[d] N.N. Semenov Institute for Chemical Physics, Russian Academy of Sciences, Moscow, Russian Federation

Corresponing author: email: vshetab@razi.tums.ac.ir

Abstract

The magnetic isotope effect of $^{25}Mg^{2+}$, *the only magnetic magnesium isotope* (+5/2 nuclear spin, 0.85 Bohr magneton magnetic moment, 10% natural abundance), has been found to be an essential, *overactivating*, element in the magnesium-dependent ATP production control processes. Being Mg^{2+}-dependent processes, both substrate and oxidative phosphorylation pathways might be activated up to 2.5-fold more efficiently by milimolars of $^{25}Mg^{2+}$ as compared to non-magnetic $^{24}Mg^{2+}$ (0 spin, 78% natural abundance) and $^{26}Mg^{2+}$ (0 spin, 11% natural abundance) isotopes (1). A low toxic (LD_{50}=896 mg/kg, i.v., rats), amphiphilic (430 mg/ml water, pH 7.40), membranotropic and cluster forming 1.8-2.0 nm fullerene-C_{60} based nanoparticles has been recently designed for correction of hypoxia-induced ATP depletion (2). This product, which possesses a marked cationite properties, is the iron containing porphyrin monoadduct of a classical Buckminster fullerene, buckminster-fullerene(C_{60})-2-(butadiene-1-yl)-tetera(o-γ-aminobutyryl-o-phtalyl)ferroporphyrin. Hereafter, we refer it to "Porphylleren-MC16" or, in brief, PMC16 (2). This smart nanocationite with membranotropic properties release the overactivating cations *only* in response to the intracellular acidosis (2). 1-methyl nicotineamide (MNA) and creatine thiophosphate (Quellicydin, QLD) as energy metabolism competitive inhibitors of oxidative phosphorylation (1) and creatine kinase (CK) (3) respectively were used in the present study. These materials induce cellular hypoxia and consequently cellular acidosis (2).

The present work concerns preventive effect of ^{25}Mg-PMC16 (PMC16 containing ^{25}Mg isotope) in rat peripheral blood lymphocytes affected by chemical hypoxia and consequently ATP depletion and cell death induced by MNA and QLD with respect to cationite properties of the new nanomedicine tested.

RNA Interference-Mediated Silencing of Nucleostemin Disrupts Cell Cycle Progression and Induces Cell Apoptosis in Bladder Cancer Cell Lines

Parvaneh Nikpour[a], Seyed Javad Mowla[a,*], Seyed Mehdi Jafarnejad[b], Wolfgang Arthur Schulz[c]

[a] *Department of Genetics, Faculty of Basic Sciences, Tarbiat Modares University, P.O. Box: 14115-175, Tehran, Iran*

[b] *Nanomedicine and Tissue Engineering Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran*

[c] *Department of Urology, Heinrich Heine University, Moorenstr. 5, 40225, Düsseldorf, Germany*

Abstract

Nano-biological techniques may increase the efficiency of tumor treatment. Since modern drug discovery is target-driven, a main limitation is to know which gene products are functionally involved in the pathogenesis of cancer (target validation) and the drugability of the gene products by small molecule compounds. RNA interference is a mechanism of gene regulation exerted by double stranded RNA. Synthetic small double-stranded RNAs acting in this way have recently received major attention as research tools in mammalian molecular biology and as potential gene-specific therapeutics. Our research based on the “stem cell model for cancer”, which assumes that a key event in tumorigenesis is the disruption in expression and function of genes involved in the regulation of stem cell self-renewal. Therefore, we have studied a stem cell self-renewal gene, Nucleostemin (NS), in bladder carcinoma cell lines and several independent primary cultures of normal uroepithelial cells. RNAi-mediated suppression of NS gene was further investigated as a potential target for therapeutical intervention.

Prednisolone Loaded Gelatin Nanoparticles By Two-Step Desolvation Method: Implications In Drug Delivery

Zahra Babaei, Mohsen Jahanshahi*, Forough Toubi
Nanobiotechnology Research Laboratory, Faculty of Chemical Engineering, Noshirvani Mazandaran University of Technical, Babol, Iran, . POBox 484.
**Corresponding author: mjahan@nit.ac.ir*

Abstract

Application of nanotechnology in drug delivery systems has opened up new areas of research in sustained release of various drugs. Due to their size, nanoparticles have the advantage of reaching otherwise less accessible sites in the body by escaping phagocytosis and entering tiny capillaries. In sensitive regions like the eye they have the advantage of causing minimal irritation. Sustained release of the drug from the nanoparticles maintains the therapeutic concentration for long durations. We prepared prenisolone loaded gelatin nanoparticles by two-step desolvation. Prednisone is also used to treat other conditions in patients with normal corticosteroid levels. Gelatin being both bioacceptable and biodegradable has a distinct advantage as a vehicle of drug delivery. By varying pH from 2 to 3 we obtained stable nanoparticles of sizes 249.3 nm to 263.1 nm respectively with low polydispersity. Photon Correlation Spectroscopy (PCS) and Scanning Electron Microscopy (SEM) of the samples were done to characterize the nanoparticles Drug encapsulation measured by UV spectroscopy varied from 25% to 43% for different pH. From the above results we can conclude that two-step desolvation method is well suited to produce gelatin nanoparticles. Nanoparticles thus produced, can be applied for intra-articular therapy in arthritis.

Keywords: Gelatin, Nanoparticles, Drug loading, Prednisolone, SEM, Encapsulatio, PCS, two-step desolvation, size distribution.

Nano-probing of tumor cell adhesion, migration and metastasis

Muhammad H. Zaman
Department of Biomedical Engineering, The University of Texas at Austin, USA

Abstract

Cell adhesion and migration play a fundamental role in tumor metastasis, the process by which cells move from host tumor to distant parts of the body. As metastasis is responsible for nearly all cancer related deaths, a fundamental understanding of processes underlying metastasis is critical for our ability to combat and cure cancer. We use a combination of high throughput and high-resolution microscopy, micro and nano-rheology and computer simulations to study the interaction of functionalized nano-particles with extra-cellular adhesion receptors, cytoskeletal proteins and cell signaling regulators. Our studies in 2D and 3D using a number of prostate cancer cell lines how cells interact with motile and immobilized nano-ligands, and point to a phase transition in adhesion strength as a function of ligand size, concentration and interaction energy. Similarly, our nano-rheology studies show the correlation between highly invasive systems cells having higher than usual stiffness and elasticity. Finally, our nano-probes are also able to shed light on the complex interactions between cells and extra-cellular matrices during invasion and migration in 3D matrices. These results outline various potential avenues to develop a fundamental understanding of cancer and identify novel therapeutic targets through a multi-disciplinary computational and experimental approach utilizing functionalized nano-particles.

Snail Knockdown by RNA Interference Inhibits Growth of Selected Human Metastatic Prostate Cancer Cell Lines

M. Baygi Emadi[a], Z. S. Soheili[b], S. Sameie[c], W. A. Schulz[d]

[a] *Department of Genetics, Faculty of Basic Sciences, Tarbiat Modarres University, Tehran, Iran*

[b] *Biochemistry Department, National Institue of Genetic Engineering and Biotechnology, Tehran, Iran*

[c] *Iranian Blood Transfusion Center, Tehran, Iran*

[d] *Department of Urology, Heinrich Heine University, Düsseldorf, Germany*

Abstract

RNA silencing is poised to have a major impact on the treatment of human cancers. Early proof-of-principle experiments in various tumor cells showed that RNA silencing has great potential as a means for treating cancer. Nanoparticles have turned out as ideal carriers for siRNA molecules. In particular, nanoparticles may provide the ability to target these molecules to cancer cells, having them taken up efficiently and release the RNA molecules into the cell interior. Identifying suitable targets for such approaches is an essential prerequisite for such therapies. In the present study, we evaluated the role of Snail, a master regulator of EMT, in two metastatic prostate cancer cell lines, LNCaP and PC-3, with different androgen responsiveness and tumorigenicity, using transient *Snail* interference by siRNA.

Bio-nanotechnology 5

A study on Nanostructured titania membrane and photocatalytic activity

Ali Alem, Hossein Sarpoolaky
Department of Metallurgical and Material Engineering, Iran University of Science and Technology, Tehran, Iran
Corresponding author: hsarpoolaky@iust.ac.ir

Abstract

Nowadays water pollution, caused by hazardous organic chemicals used in industry and agriculture, is a very serious problem. Food, pharmaceutical, pesticides, the textile dyeing and finishing industry produces large volumes of discharge effluent and is considered as one of the major industrial pollutants [1,2]. As a new method, membrane separation processes have been studied in order to reuse wastewater derived from many fields by means of nano and ultrafiltration of discharge effluent [3-5]. Membrane separation processes have already shown to be competitive with other separation processes for what concerns energy costs, material recovery, reduction of the environmental impact and achievement of integrated processes with selective removal of some components [6,7]. However, this technique only transfers pollutants from a phase to another and only displays a simple separation function. Photocatalytic reactions allow in many cases a complete degradation of organic pollutants in very small and innoxious species, without using chemicals, avoiding sludge production and its disposal. Over the past several years TiO2 nanostructures have become a focus of considerable interest because they prove to be a promising technology for purification and treatment of both contaminated air and water [8].

Isolation of a chemolithotroph acidophilic bacterium of Qotoursou spring in Ardebil province for using in bioleaching

Hassan Assadinia
Pyame Nour University

Abstract

Continues extraction of mines has caused lack of storage such mines in lapse of time and consequently we would come to leakage of metals in feature. So for solving problems we need developing effective process in order to using ores with low rover. Nowadays is going to use microbial leaching of technology for extraction valuable metals from ores with low rover. In this study one strain gram-positive chemolithotroph acidophilic bacteria was segregated from mineral acidic and sulfuric water of Qotoursou spring in Ardebil province. Segregated strain is able to oxidation of ferrous iron, elemental sulfur, thiosulfate and iron sulfide and in result of oxidation ferric iron sulfate is going to produced witch is an intense oxidance and is of great importance in extracting metals from sulfidy mines. This strain has the optimum growth in temperature at 50 ^{o}C and pH= 3. In this study segregated strain grew in culture containing sample of mine of Sarcheshmeh copper and Gendy gold mine and oxidize copper existing in chalcopyrite from unsolution form to solution copper sulfate in water.

Keywords: Microbial leaching, Chemolithotroph, Acidophilic, Qotoursou spring

Quantum dots application in the detection of pathogenic microorganisms

Munawwar Ali Khan

Department of Biotechnology, Manipal University Dubai Campus, Block-7, Dubai International Academic City, P.O.Box: 500689, Dubai, United Arab Emirates

Corresponing author: mkhan@mahedubai.com

Abstract

The presence of pathogenic microorganisms in various water sources is commonly determined by using nucleic acid or antibody based fluorescent techniques. However, different water samples can contain inert particles or algal cells with strong autofluorescence and light scatter characteristics similar to those of fluorescently labeled microbial cells. This can significantly impede the detection specificity of various fluorescent based assays for microbial cells detection but can be minimized by carefully selecting fluorescent dyes with minimal interference from fluorescent waterborne particles. Nevertheless, most of these fluorescent dyes all are susceptible to photobleaching and have broad excitation and emission spectra, which often limit their uses in multiplexing detection. Semiconductor quantum dots (QDs) or nanocrystals (5 to 50 nm in size) have recently emerged as a novel and promising class of fluorophores for cellular imaging. Unlike conventional organic dyes, QDs can be excited by a wide spectrum of wavelengths to give great photostability, and their emission spectra, which differ according to size and material composition, are narrow, symmetrical, and tunable. With these characteristics, QDs have minimal interference from natural autofluorescent particles and can be a superior fluorophore in the multiplexing detection of different molecular targets in various biological specimens. This novel detection system can significantly improve the efficiency and throughput on the identification of important microbes related to human diseases and natural/engineered systems. In this paper, basic introduction of QDs, their properties and application in detection of microbial cells in environment have been described.

SPECTRUM OF APPLICATION MAGNETITE NANOPATICLES IN MEDICINE

Andrey N. Belousov
Laboratory of Applied Nanothechnology, pr. Lenina, 31-v, fl. 32, Kharkov, 61072 Ukraine
Corresponding author: anb@vlink.kharkov.ua

Abstract

Nowadays nanotechnology as a new direction of science allows to develop therapeutic methods of the endogenous intoxication syndrome and to create a new class of biocompatible sorbents. In Ukraine first preparations of medical nanotechnology were produced and patented in 1998. These are “IKBB” intracorporal biocorrector, magnetically controlled sorbent (MCS-B), and “Micromage-B”. The preparations are based on colloid magnetite particles (Fe_3O_4) from 6 to 12 nm. Adsorption layer provides a high sorption activity to magnetite nanoparticles. Total activity of their sorption surface is 800 – 1200 m^2/g, magnetic field intensity produced by each particle is 300 - 400 kA/m, ζ – potential is – 19 mV. Each magnetite particle is a subdomain elementary magnetite of a sphere shape. The main biological action of nanotechnology preparations is direct to regulation of cell metabolism. Therapeutic effect of this preparation is based on the influence of adsorption process and of constant magnetic field that surrounds colloid magnetite particle on cellular and subcellular structures. Point of attack is surface proteins of cell membranes. Colloid magnetite particles modify composition of protein molecules thereby effecting transport of substances to a cell. Using magnet-controlled sorbent the method of extracorporal hemocorrection on the whole is rather the method of effective and reliable way to activate natural processes of detoxication of organism, than the method of artificial detoxication. The absence of contra-indication and incidental effects (haematic, haemodynamic, hormone, electrolytic, immune) creates real predisposition for using this method in intensive therapy of intoxication syndrome.

Keywords: magnetite nanoparticles; medical nanotechnology; regulation of cell metabolism; intensive therapy; intoxication syndrome.

Surface Magnetization of Nanoparticles Controls the Magnetic Hyperthermia Process

Ihab M. Obaidat[a,*], Bashar Issa[b], Virendra Mohite[c], Yousef Haik[c,d]

[a] *Department of Physics, United Arab Emirates University, Al-Ain 17551, United Arab Emirates*

[b] *Center for Nanomagnetics and Biotechnology, Florida State University, FL 32310*

[c] *Department of Mechanical Engineering, United Arab Emirates University, Al Ain, United Arab Emirates*

[d] *Center for Research Excellence in Nanobiosciences, University of North Carolina-Greensboro, USA, NC*

[*] *Corresponding author: E-mail address: iobaidat@uaeu.ac.ae*

Abstract

The control of Curie temperature is very necessary in Hyperthermia where cancerous cells are heated up to temperatures of 42-43ºC using magnetic nanoparticles. In this paper we point out that surface spins have a major role in determining the Curie temperature of ferrite $Mn_{0.5}Zn_{0.5}Gd_xFe_{2-x}O_4$ (x = 0, 0.2 0.5, 1.0, and 1.5) and $Mn_{1-x}Zn_xFe_2O_4$ (x = 0.5, 0.6, and 0.8) nanoparticles. The addition of Gd in the $Mn_{0.5}Zn_{0.5}Gd_xFe_{2-x}O_4$ increases the size of the nanoparticles. Accordingly due to changes in lattice spaces surface disorder occurs and results in surface spins. For each particular x value, the magnetization remains nearly constant for temperatures less than 50 K. As the temperature was increased further, a sudden and large increase in the magnetization occurs. The magnetization of the particles was found to exhibit a peaked region before it diminishes at high temperatures. The Curie temperature was found to increase up to x = 1.0, and then decreases at x = 1.5. Similar qualitative results were obtained when Zn was added to the MnZnFeO ferrite. The existence of the initial constant magnetization and the appearance of the peaked regions were considered to be signatures of surface spin-glass structures. A core-shell magnetization model of the ferromagnetic surface and the ferrimagnetic core was introduced and was successful in accounting for these results.

Keywords: Hyperthermia; Surface spins; Nanoparticles

Computation 1

Topological Indices of Nanostar Dendrimers

A. Karbasioun[*], Ali Reza Ashrafi
Institute of Nanoscience and Nanotechnology, University of Kashan, Kashan 87317–51167, Iran
[*] *Corresponding author: karbasioun@grad.kashanu.ac.ir*

Abstract

Let G be the molecular graph of a nanostar dendrimer. The Wiener and detour indices of G are defined as the sum of the lengths all shortest and longest paths between vertices of G. The aim of this paper is to compute some exact formulae for the Wiener and detour indices of G.

Keywords: Nanostar dendrimer, molecular graph, Wiener index, detour index

SRO5 Scope Number: A G3 study of the structure of carbon-nitrogen CnNm+ (n=1-4, m=1-4, n+m=5) cation nanoclusters

Muneerah M. Al-Mogren, Adel El-Azhary, Kaled Al-farhan, Wad Kealie
Chemistry Department, Faculty of Science, King Saud University, P.O.Box 2455, Riyadh, 11451, Saudi Arabia

Abstract

Optimized geometries, energies, vibrational frequencies, HOMO-LUMO energy gaps, spin contamination and term symbols of the different possible structures of the carbon-nitrogen $C_mN_n^-$ (m = 1–4, n = 1–4, $n + m$ = 5) anion nanoclusters were calculated. Initial computations were done at the HF/STO-3G level assuming fifteen possible structures of these clusters. Further computations were performed at the HF, B3LYP and MP2 levels using the 6-311+G* basis set and with the G3 method. Structures with imaginary vibrational frequencies at the HF/6-31G* level of the G3 method were excluded. In addition, it was not possible to obtain structures for some clusters due to geometry optimization and SCF convergence problems. The calculated results are discussed for each of the considered clusters.

Computing Topological Indices of Nanostar Dendrimers

Ali Reza Ashrafi
Institute of Nanoscience and Nanotechnology, University of Kashan,
Kashan 87317-51167, I. R. Iran
Corresponding author: ashrafi@kashanu.ac.ir

Abstract

Nanobiotechnology is a rapidly advancing area of scientific and technological opportunity that applies the tools and processes of nanofabrication to build devices for studying biosystems. Dendrimers are one of the main objects of this new area of science. Here a dendrimer is a synthetic 3-dimensional macromolecule that is prepared in a step-wise fashion from simple branched monomer units, the nature and functionality of which can be easily controlled and varied. The nanostar dendrimer is part of a new group of macromolecules that the structure and the energy transfer mechanism must be understood.

A map taking graphs as arguments is called a graph invariant or topological index if it assigns equal values to isomorphic graphs. A dendrimer is an artificially manufactured or synthesized molecule built up from branched units called monomers.

Recently, Padmakar Khadikar defined a new topological, named PI index. This newly proposed topological index does not coincide with the Wiener index for acyclic molecules. It is defined as $PI(G) = \sum_{e=uv\in G}[m_u(e)+ m_v(e)]$, where $m_u(e)$ is the number of edges of G lying closer to u than to v and $m_v(e)$ is the number of edges of G lying closer to v than to u. Edges equidistant from both ends of the edge uv are not counted. The Szeged index, is another topological index introduced by Ivan Gutman. To define the Szeged index of a graph G, we assume that e = uv is an edge of G, $n_u(e)$ is the number of vertices of G lying closer to u and $n_v(e)$ is the number of vertices of G lying closer to v. Then the Szeged index of the graph G is defined as $Sz(G) = \sum_{e=uv\in E(G)}n_u(e)n_v(e)$. Notice that vertices equidistant from u and v are not taken into account.

In this paper our notation is standard. We first report our latest results on the subject of topological indices of nanostar dendrimers. Then a novel method for computing topological indices of dendrimer nanostars is presented by which it is possible to compute the PI index of these nanomaterials.

Keywords: Nanostar dendrimer; Topological index; Molecular graph

Computing a topological index of the first type dendrimer nanostars

Ali Iranmanesh[a,*], Nabiallah Gholami[a], Ali Ahmadi[b]

[a] *Department of Mathematics, Tarbiat Modares Universit, P.O.Box: 14115-137, Tehran, Iran*

[b] *Academic Center for Education, Culture and Research TMU, P.O.Box : 14115-343, Tehran, Iran*

[*] *Corresponding author: iranmana@modares.ac.ir*

Abstract

Let e be an edge of a G connecting the vertices u and v. Define two sets $N_1(e|G)$ and $N_2(e|G)$ as $N_1(e|G)=\{x\in V(G)|d(x,u)<d(x,v)\}$ and $N_2(e|G)=\{x\in V(G)|d(x,v)<d(x,u)\}$. The number of elements of $N_1(e|G)$ and $N_2(e|G)$ are denoted by $n_1(e|G)$ and $n_2(e|G)$ respectively. The Szeged index of the graph G is defined as $Sz(G)=\sum_{e\in E} n_1(e|G)n_2(e|G)$. In this paper we compute the szeged index of the first type of dendrimer nanostar.

The Symmetry Group of Nanotubes

Morteza Faghani[a], Ali Reza Ashrafi[b]

[a]Department of Mathematics, University of Payame Noor, Tehran, I. R. Iran

[b] Institute of Nanoscience and Nanotechnology, University of Kashan, Kashan, 87317-51167, I. R. Iran

[*] Corresponding author: ashrafi@kashanu.ac.ir

Abstract

Carbon nanotubes form an interesting class of carbon nanomaterials. These can be imagined as rolled sheets of graphite about different axes. These are three types of nanotubes: armchair, chiral and zigzag structures. Further nanotubes can be categorized as single-walled and multi-walled nanotubes and it is very difficult to produce the former.

A large number of chemical and physical properties of various small molecules are closely related to the geometrical nature of their skeletal structure. Symmetry is one of the most important geometrical properties of molecules and it is well-known fact that such transformations have a group or quasi group structure.

Enumeration of chemical compounds has been accomplished by various methods. The Polya-Redfield theorem has been a standard method for combinatorial enumerations of molecular graphs, polyhedra, chemical compounds, and so forth. A colouring of the vertices, edges, or faces of a nanotube with k colours can be interpreted as a function from the set of all vertices, edges, or faces into the set of k colours. Two colourings are called different if and only if the corresponding functions lie in different orbits of the group R or S acting on the set of all these functions in a natural way. Here R is the set of all rotational symmetries and S is the full symmetry group of nanotube under consideration. From the cycle indices one can compute the number of different colourings using k colours via Polya-theory by replacing each variable x_i in the cycle index by k.

Suppose L is the 2-dimensional lattice of a polyhex nanotube containing p vertical crenels and q rows. The rotating group H of the molecular graph L is generated by a = (1,…,p/2) or (1,..,(p-1)/2) and b = (2,p/2)(3,p/2-1)… (p/4,p/4+2) or (2,p/2)(3,p/2-1)…((p/2+1)/2,(p/2+3)/2), when p/2 is even or odd, respectively. Then the group H = <a,b> is the rotating group of a polyhex nanotube. Here, we apply methods similar to one of our earlier paper and some GAP programs to construct new type of nanotubes.

Keywords: Nantube; Symmetry; Molecular graph

Computation 2

Computing Hyper- Wiener and Schultz Indices of $TUZC_6$ [p,q] Nanotube by GAP Program

A. Iranmanesh[*], Y. Alizadeh

Department of Mathematics, Tarbiat Modares University, P. O. Box: 14115-137, Tehran, Iran

[*] *Corresponding author: iranmana@modares.ac.ir*

Abstract

Topological indices of nanotubes are numerical descriptors that are derived from graph of chemical compounds. Such indices based on the distances in graph are widely used for establishing relationships between the structure of nanotubes and their physicochemical properties. Usage of topological indices in biology and chemistry began in 1947 when chemist Harold Wiener [1] introduced Wiener index to demonstrate correlations between physicochemical properties of organic compounds and the index of their molecular graphs. The hyper-Wiener index is one of the recently conceived distance-based graph invariants, used as a structure-descriptor for predicting physico–chemical properties of organic compounds. The hyper-Wiener index was invented by Randic´ (1993) and was eventually extensively studied [2,3]

Let G be a connected graph. The vertex-set and edge-set of G denoted by V(G) and E(G) respectively. The distance between the vertices u and v, d(u,v), in a graph is the number of edges in a shortest path connecting them. Two graph vertices are adjacent if they are joined by a graph edge. The degree of a vertex $i \in V(G)$ is the number of vertices joining to i and denoted by $v(i)$. The (i,j) entry of the adjacency matrix of G is denoted by $A(i,j)$. The hyper-Wiener index of a graph G is denoted by W*W (G)* and defined as:

$$WW(G)=\frac{1}{2}\sum_{i<j} d(i,j)+\frac{1}{2}\sum_{i<j} d(i,j)^2 \qquad (1)$$

where *d*(*i, j*) stands for the distance between the vertices *i* and *j* in the graph *G*.

Another topological index is Schultz index, the Schultz index (MTI) was introduced by Schultz in 1989, as the molecular topological index [4], and it is defined by:

$$MTI = \sum_{\{i,j\}\subseteq V(G)} v(i)(d(i,j)+A(i,j)). \qquad (2)$$

In this paper, we give an algorithm for computing the hyper-Wiener and Schultz indices of any graph and by this algorithm; we obtain the hyper-Wiener and Schultz indices of TUZC6 [p,q] nanotube.

Keywords: hyper-Wiener index, Schultz index, Nanotubes, Gap programming

The effects of nonlinear gain on the quantum well VCSEL characteristics

M. Aghaeepour[a], V. Ahmadi[a,*], E. Darabi[b]

[a] *Department of Nanomaterial Engineering, Tarbiat Modares University, Tehran, Iran*

[b] *Department of Physics, Science and Research Branch, Islamic Azad University, Tehran, Iran*

[*] *Corresponding author, Email: v_ahmadi@modares.ac.ir*

Abstract

Vertical cavity surface emitting lasers (VCSEL) has emerged as an important light source due to very brilliant characteristic in optical systems such as low cost and low divergence output.

In this paper, we present an opto-electro-thermal model for VCSEL. The model is applied to an index-guided structure with a 5 μm oxide aperture and 3 quantum-wells in active layer. The interdependent process of carrier transport, heat generation and optical field are solved self-consistently for each point of time and space using Finite Difference Method (FDM) in cylindrical system. The quantum well (QW) gain is computed for different carrier injected concentrations considering band-mixing effect in valance band and parabolic model for conduction band. The QW-gain has a nonlinear third order polynomial form. The inclusion of QW maximum gain calculation for constant wavelength in the model allows us to study threshold current value and higher order transverse modes as well as their dependencies on changes of gain and refractive index induced by carrier and heating more accurately than linear gain approximation. The calculated threshold current decreases compared with linear gain model used in other works. For injection current above the threshold, we consider the spacial hole burning (SHB) effect using nonlinear gain. The results show more increase of SHB effect in active layer for nonlinear gain of LD. Although the SHB effect and its increase are undesired, it improves the index guiding effect due to self focusing and postpones the appearance of higher order modes. Our calculated results based on the model agree well with experimental reports.

Keywords: Finite difference method, nonlinear gain, SHB effect, quantum well, opto-electro-thermal, VCSEL

Edge-Wiener index of armchair polyhex nanotubes

Ali Iranmanesh, Abolghasem Soltani, Omid Khormali

Department of Mathematics, Tarbiat Modares University, P. O. Box: 14115-137, Tehran, Iran

Corresponing author: iranmana@modares.ac.ir

Abstract

The vertex version of Wiener index $W(G)$ of a connected graph G is the sum of distances between all pairs of vertices of G, that is,

$$W(G) = \sum_{u,v \in V(G)} d_G(u,v)$$

.

This index was introduced by the chemist Harold Wiener [1], in the study of relations between the structure of organic compounds and their properties.

In this paper we present a method for calculating a topological property, namely edge-Wiener Index (see [2]), for Armchair Polyhex nanotubes (see Figure 1).

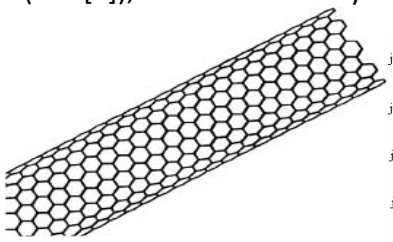


Figure 1. $TUAC_6(p,q)$

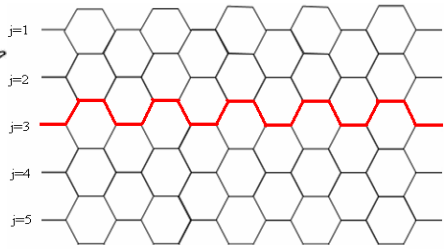


Figure 2. An armchair polyhex lattice

In Figure 2 we illustrated armchair polyhex lattice that have p and q hexagonal respectively in length and width. For definition of edge-Wiener index, we introduced distances between edges, because, the topological indexes such as Wiener index depend to distances, and according to these distances, we introduced one type of edge-Wiener index. Let G be a graph, and $V(G), E(G)$ are the set of vertices and set of edges, respectively. And in this paper, we suppose G is connected.

Let $e, f \in E(G)$ and let $e = (u,v), f = (x,y)$.

If $d_1(e,f) = \min\{d(u,x), d(u,y), d(v,x), d(v,y)\}$ and $d_0(e,f) = \begin{cases} d_1(e,f)+1 & ,e \neq f \\ 0 & ,e = f \end{cases}$,

Then we have edge-Wiener Index as following:

$$W_{e0}(G) = \frac{1}{2} \sum_{e,f \in E(G)} d_0(e,f)$$

Counting the number of hetero fullerenes C_{180-k} B_k

Ahmad Gholami[*], Ali Reza Ashrafi
Department of Mathematics, Faculty of Science, University of Kashan, Kashan, I. R Iran
[*] *Corresponding author: gholami@kashanu.ac.ir*

Abstract

Heterofullerenes are fullerene molecules in which one or more carbon atoms are replaced by heteroatoms such as boron or nitrogen, whose formation is a kind of "on-ball" doping of the fullerene cage. Fripertinger computed the number of $C_{60-k}B_k$ Fullerene, where B is an atom (see H. Fripertinger, MATCH Commun. Math. Comput. Chem., 33 (1996), 121). In this paper using Group theory and the computer algebra systems GAP and MAGMA, we extend the results of Fripertinger to compute the number of $C_{180-k}B_k$ molecule.

Keywords: Fullerene, hetero fullerene, cycle index, permutation group

Design and Analysis of Near Room Temperature InAs/GaAs QDIP Using FDM for Far Infrared 8-12 µm Windowsf

A. Mir-Derikvandi, V. Ahmadi*

Department of Electrical Engineering, Tarbiat Modares University, Tehran, Iran

**Corresponding author: v_ahmadi@modares.ac.ir*

Abstract

In this paper, we study the mid and far infrared wavelength absorption through the conduction subbands, in quantum dots using the effective mass Schrödinger equation and 8-band K.P method with cubic and pyramid shape quantum dot structures by FDM. Then we determine the base size of dot for peak absorption wavelengths in the range of 8-12 µm and calculate spectrum absorption of quantum dots. We conclude that for far infrared region (8-12 µm) in pyramid shape quantum dot structures, the base size should be greater than 16 nm without considering band mixing effect, but with considering the band mixing it will be less than 16 nm. For cubic quantum dot, smaller size is required. Based on the simulation results, we design the quantum dot infrared photodetector device to detect in the range of 8-12 µm and use a resonant tunneling double barrier for reduction of dark current. Then we calculate the responsivity, detectivity and dark current for this device. This resonant tunneling quantum dot infrared photodetector (QDIP) has a relative large absorption (~2×10^4 cm^{-1}), responsivity(~100 mA/W), and detectivity (~10^{10} $cm.Hz^{1/2}/W$), at near room temperature in the range of 8-12 µm windows.

Keywords: QDIP, Resonant Tunneling, Pyramid Shape, Responsivity, Detectivity

The Vertex Kekule Structures of Nanotubes and Nanotori Covered by C_4

Gholam Hossein Fath-Tabar[a,*] , Amir Loghman[b]

[a] *Department of Mathematics, Faculty of Science, University of Kashan, Kashan 87317-51167, I. R. Iran*

[b] *Department of Mathematics, University of` Payame Noor, I. R. Iran*

Corresponding author: fathtabar@kashanu.ac.ir

Abstract

Throughout this paper G is a simple graph, that is, G does not have loops or multiple edges. Let {1,... ,n } be the set of vertices of G and d_i = deg(i) denotes the degree of the vertex i. An edge set A is called independent if there is no vertex in common between any two edges A. Also if this set has r elements we call r-edge set to be independent. Matching polynomial of graph G is defined by the sum of $(-1)^r q(G,r)x^{n-2r}$, in which q(G,r) is the number of r-edge independent set of G. Let G = (V,E) be a (n,m)-graph where m and n be the number of vertices and edges of G, respectively. The vertex matching polynomial $M_v(G,x)$ of the graph G is defined as the sum of $(-1)^r q_v(G,r)x^{n-r}$ in which $q_v(G,r)$ is the number of r-vertex independent set. In this paper, we extend some important properties of the matching polynomial to the vertex matching polynomial $M_v(G,x)$. The matching and vertex matching polynomials of some important class of nanostructures containing nanotubes and nanotori covered by C_4 are computed.

Keywords: Nanotube, Nanotorus, Vertex Kekule Structures

Computation 3

PI Index of Single and Multi-walled C_4C_8 Nanotube

H. Yousefi-Azari[a], M. H. Khalifeh[a,*], A. R. Ashrafi[b]

[a] School of Mathematics, Statistics and Computer Science, University of Tehran, Tehran, I.R. Iran

[b] Department of Mathematics, Faculty of Science, University of Kashan, Kashan 87317-51167, I.R. Iran

[*] Corresponding author: khalife@khayam.ut.ac.ir

Abstract

A C_4C_8 net is a trivalent decoration made by alternating squares C_4 and octagons C_8. Such a covering can be derived from square net by the leapfrog operation. Stefu and Diudea recently computed the Wiener index of such nanotubes.

Let G be a simple molecular graph without directed and multiple edges and without loops, the vertex and edge-sets of which are represented by V(G) and E(G), respectively. A topological index of a graph G is a numeric quantity related to G. The oldest topological index is the Wiener index. Numerous of its chemical applications were reported and its mathematical properties are well understood.

Recently, Khadikar and co-authors defined a new topological index and named it Padmakar-Ivan index. They abbreviated this new topological index as PI. This newly proposed topological index does not coincide with the Wiener index for acyclic molecules. It is defined as $PI(G) = \sum_{e\in G}[n_u(e) + n_v(e)]$, where $n_u(e)$ is the number of edges of G lying closer to u than to v and $n_v(e)$ is the number of edges of G lying closer to v than to u.

In some research papers Mircea Diudea and his co-authors computed the Wiener index of some nanotubes and nanotori. The present authors computed the PI index of some nanotubes and nanotori. In this paper, we continue this program to compute the PI index of a class of C_4C_8 single and multi-walled nanotubes. Our notation is standard and mainly taken from the standard book of graph theory.

Keywords: C_4C_8 nanotube, PI index, molecular graph

Topological Indices of One-Pentagonal Nanocones

H. Yousefi-Azari[a,*], M. H. Khalifeh[a], A. R. Ashrafi[b]

[a] School of Mathematics, Statistics and Computer Science, University of Tehran, Tehran, I.R. Iran

[b] Department of Mathematics, Faculty of Science, University of Kashan, Kashan 87317-51167, I.R. Iran

Corresponding author: yousefi@ut.ac.ir

Abstract

One pentagonal carbon nanocones originally discovered by Ge and Sattler in 1994. These nanocones are constructed from a graphene sheet by removing a 60° wedge and joining the edges produces a cone with a single pentagonal defect at the apex.

Let G be a simple molecular graph without directed and multiple edges and without loops, the vertex and edge-sets of which are represented by V(G) and E(G), respectively. Two graphs G and H are said to be isomorphic if there is a one-to-one and onto map α: $G \rightarrow H$ such that adjacency of $x,y \in V(G)$ implies that the adjacency of $\alpha(x), \alpha(y) \in V(H)$ and vice versa. If G is isomorphic to H then we write $G \cong H$ and if G = H then α is called an automorphism of G. A topological index of a molecular graph G is a numeric quantity related to G. It is invariant under isomorphism from G onto an arbitrary graph H. In other words, if Top is a topological index and G and H are two isomorphic graphs then Top(G) = Top(H).

The most important works on the geometric structures of nanotubes, nanotori and their topological indices were done by Diudea and his co-authors. The present authors continued this program to calculate some other nano-materials. The aim of this article is computing PI, vertex PI, Wiener and Szeged indices of the one pentagonal carbon nanocone.

Keywords: One-pentagonal carbon nanocone, PI index, vertex PI index, Wiener index, Szeged index

Finite Element Modeling of Aligned Nanocomposite

S. Aldajah[a,*], Y. Haik[a,b], M. Alrawadeh[a]

[a] *Department of Mechanical Engineering, United Arab Emirates University, Al-Ain 17551, United Arab Emirates*

[b] *Center for Research Excellence in Nanobiosciences, University of North Carolina-Greensboro, NC, USA*

Corresponding author: s.aldajah@uaeu.ac.ae

Abstract

The use of carbon nanotubes (CNTs) as reinforcing materials in nano-composites has originated the need to explore their mechanical properties and assess their deformation under mechanical loading. The characterization of CNTs is more complex than that of conventional materials due to the dependence of their mechanical properties on size and nano-structure. Many researchers have focused on modeling CNTs.

The development of a finite element model that is appropriate for the computation of Young's modulus of nanocomposite materials is the purpose of this research. The model development is based on the assumption that carbon nanotubes can be modeled as beam elements using ABAQUS software package. A control volume method is employed where it is assumed that the nanocomposites have geometric periodicity with respect to local length scale and the elastic properties of nanocomposites can be represented by those of the representative volume element. The effective elasticity tensor predicted by this method is compared with analytical and experimental results available in the literature. Results showed a very good agreement between the experimental and the FEM results.

Keywords: FEM; Nanocomposite; Nanoparticles

The first edge-wiener index of $TUC_4 C_8$ (S) nanotubes

O. Khormali[a,*], A. Iranmanesh[b]

[a] *Mathematics and Informatics Research Group, Academic Center for Education, Culture and Research, Tarbiat Modares University, P.O.Box : 14115-343, Tehran, Iran*

[b] *Department of Mathematics, Tarbiat Modarres University, P.O.Box: 14115-137, Tehran, Iran*

[*] *Corresponding author: o_khormali@yahoo.com*

Abstract

The oldest topological index is the ordinary (vertex) version of Wiener index which introduced by Harold Wiener in 1947. So many scientific works have been done on this index in Chemistry and Mathematics. The edge versions of Wiener index was introduced by Iranmanesh et al. very recently. In this paper, the first type of edge-Wiener index of $TUC_4C_8(S)$ nanotube is computed.

Keywords: Vertex-Wiener index, Edge-Wiener indices, Nanotube, Molecular graph

Environment 1

Removal of Refractory Sulfur from Model Diesel Using Granular Activated Carbon from Dates' Stone

Hisham Saeed Bamufleh
Chemical and Materials Engineering Department, King Abdulaziz University, Jeddah, Saudi Arabia
Corresponding author: hbamufleh@kau.edu.sa

Abstract

Increasingly stringent environmental efforts are devoted to phase out sulfur from transportation fuels, which are the main cause of acid rain and poisoning of catalysts in CO and NO_x catalytic converters. Refineries are facing a major challenges to meet Environmental Protection Agency (EPA) Tier II regulations along with the required reduction of aromatics contents such as 4,6-dimethyldibenzothiophene.

Conventional catalytic hydrodesulfurization (HDS) processes are limited to removal of thiols, sulfides and disulfides. However, steric hindrance around the sulfur atom in refractory sulfur compounds, e.g. 4,6-dimethyldibenzothiophene(4,6-DMDBT), hampers their removal by HDS.

This work focuses on selective adsorption at very mild conditions employing granular activated carbon (GAC) as microporous materials (pore size range 2 to 5 nm) with very high surface areas and large pore volume. GAC samples prepared from date's stones, very cheap agricultural waste, by chemical activation using $ZnCl_2$ as activator. Upon preparation process of the activated carbon, three major factors are playing a significant role in the characteristics of the obtained samples. These variables include carbonization temperature, T_{carb}, weight ratio of activator to dates stones, R, and carbonization time, θ_{carb}. For this activator three T_{carb} levels of 500 ºC, 600 ºC and 700 ºC, two θ_{carb} periods of 1 and 3 hrs and two ratios (R) of 0.5 and 2.0 were used. Textural characteristics of GAC were determined by N_2 adsorption at 77 K by which BET surface area and pore size distribution and pore volumes were determined.

GAC samples were used in desulfurization of a model diesel fuel composed of n-$C_{10}H_{34}$ and dibenzothiophene (DBT) as sulfur containing compound at room temperature. The adsorption data were fitted to both Freundlich and Langmuir equations and the optimum operating condition for GAC preparation based on high adsorption capacity are suggested.

Photo catalytic degradation of azo dye direct red 23 in the presence of nano TiO_2

M. R. Sohrabi[a, *], S. Tokhmehchi[a], O. Moradi[b]

[a] *Department of Chemistry, Islamic Azad University, Nourth Theran Branch, Tehran, Iran*

[b] *Department of Chemistry, Islamic Azad University, Shahriyar-shaher-e- Gods- Branch, Tehran, Iran*

[*] *Corresponding author: mmm_sohrabi@yahoo.com*

Abstract

The textile industry produces large quantities of highly colored effluents which are generally toxic and resistant to destruction by biological treatment method. Azo dyes such az Direct red 23 are widely used in textile industry. Various chemical and physical processes such as chemical precipitation and separation of pollutants, coagulation, and electro coagulation are not destructive but they only transfer the contaminants from one to another. AOP offer new routes for the oxidative degradation of organic compound. Heterogeneous photo catalysis is one of the important destructive technologies leading to the total mineralization of most of the organic pollutant to CO2 and mineral acids (3). Photo catalytic degradation of commercial textile dye called (C.I.Direct red 23) were investigated in aqueous heterogeneous solution containing nano TiO_2 and nano TiO_2/nano ZnO as photo catalysts under UV-C mercury lamp irradiation. The experiments were monitored by UV-Vis absorption. The effect of key operating parameters such as initial pH, catalyst dosage, hydrogen peroxide, some inorganic ions were studied 100% degradation of dye was achieved by applying the optimal parameters with 1 gr/litr TiO_2, pH:3 after 3 min irradiation. Photo degradation efficiency of dye was small when photolysis was carried out in the absence of TiO_2 and negligible in the absence of UV light. The result indicates that degree of degradation of red 23 was obviously affected by pH and amount of TiO_2.

Keywords: Photo catalytic, Direct red 23, nano TiO2, UV-Vis

Use of nano filters to control the emission of NOx and carbon particles from chimneys of industries

Rohit Agarwal[a,*], V. K. Katiyar[b], Gaurav Varshney[c]

[a] *Department of Industrial and Production Engineering, Dehradun Institute of Technology, Dehradun, India*

[b] *Department of Mathematics, Indian Institute of Technology, Roorkee, India*

[c] *Department of Mathematics, Indian Institute of Technology, Roorkee, India*

[*] *Corresponding author: rohitdit88@gmail.com*

Abstract

Now days the most important problems that the mankind is facing are:

The decreasing energy resources.

The increasing consumption and need for energy.

The increasing damage to our environment.

Out of these problems, the problem which affects the flora and fauna nearby industry is "increased rate of air pollution addition to our environment". The one of major component of the air pollution produced by the chimney of the industry is NOx. This NOx contributes a lot to the damage of the animal lungs. To control NOx, nano filters can be implemented. Nano filters are the filters that have the pores of diameter of 0.27 X 10^{-6} m or less (of the order of 10^{-9} m). The nano filters can stop the flow of NOx only if the path of the flow of NOx is being modified according to the equation of flow of NOx through the pores of nano filters. Along with the modifications a few particles of aqueous solution of ammonium hydroxide can be used to control NOx. Not only this, but also the use of nano filters will prevent the soot particles of carbon at the openings the chimneys .The other methods available for the control of NOx and carbon particles, can only control them when the air comes out in the outer environment, but by this method we can control NOx and carbon particles inside the chimney only and thus the climatic conditions will not affect the filtration or control process. This method of reducing carbon soot particles and NOx will be very useful for the industries in the major cities of the world. By this method, the pollution level of the expelled air from industry will become such lower that their setup will become easier.

Keywords: Industrial Chimneys; NO_X & Soot particles; Nano Filters; NO_X Adsorbents; Pollution Control

Assessing UF-NF integrated pilot plant to supply potable water using Karoon River as feed water

Reza Davoodi
Project Manager, Iranian Nanotechnology Initiative Committee, Tehran, Iran
Corresponding author: davoodi@nano.ir

Abstract

Most of the installed membrane based water treatment plants in Iran are to produce industrial water and rarely for potable water. Almost all of them use reverse osmosis process with traditional pretreatment. In the present work, ultra-filtration is introduced as an effective and helpful pretreatment process that is developed recently and nano-filtration as an economic and energy saving treatment process. The designed pilot plant is a portable one that may be transferred easily due to its containerized design; hence there is possibility of testing various conditions with different feed waters. This study is started with the Karoon River due to high turbidity and bad quality of present potable water in the region and will follow up with other feed water qualities in Iran. The emerging conclusions of this pilot project may offer reasonable solution to solve potable water supply problem in some deprived regions of Iran and the Middle East using nano-filtration technology.

Keywords: Desalination technology, Reverse Osmosis, Nano-filtration, Ultra-filtration

Extracellular Biosynthesis of Silver Nanoparticles using fungus Fusarium oxysporum and their Antibacterial Activity

Javed Musarrat*, Sourabh Dwivedi, Saema Usmani
Department of Agricultural Microbiology, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh 202002, India
** Corresponding author*

Abstract

Microorganisms exhibit tremendous adaptability and consequently upon prolonged exposure to environment pollutants, such as metal ions, they display remarkable capability to resist metal stress. Recently, the microorganisms have been explored as potential biofactories for synthesis of metallic nanoparticles. In this study, we have used a very common soil borne fungus Fusarium oxysporum for biosynthesis of silver nanoparticles. Filamentous fungi are very good candidates for the development of extracellular processes as they secret a variety of enzymes and are easy to grow and handle. Silver nanoparticles have many important applications as staining pigments for glasses and ceramics, transparent conducting coating, in electronics, surface-enhanced Raman spectroscopy, and also as biolabelling and antimicrobial agents. Owing to their antimicrobial activity, the silver nanoparticles are being used in cosmetics as facial cream, lotions, and deodorizers, etc. Applications of silver nanoparticles in these areas depend on the ability to synthesize chemically stable particles with different chemical composition, shape, size, and monodispersity. Advancement of research in this area has led to the development of simple and ecofriendly methods of nanomaterials synthesis and their applications, exploiting the inexpensive and efficient natural processes of biological systems. In an attempt to biosynthesize silver nanoparticles, we have used the cell-free filtrate of Fusarium oxysporum (10 g) mixed with 1mM AgNO3, to obtain extremely stable silver nanoparticles of different shapes and sizes with in 120 min at 280C. The intense surface plasmon resonance band at 420 nm in the UV–Visible spectrum clearly revealed the formation of nanoparticles. The concentration of dark brown silver ions increased with time up to 3 days, as monitored by the change in absorbance at 420 nm. The size of the silver particles using Transmission Electron Microscopy (TEM) studies was found to be in the range of 16-22 nm. The X-ray diffraction (XRD) data showed the diffractions at 38.5°, 44° and 64.5° 2θ, indexed to the (111), (200) and (220) planes of the face-centered cubic (fcc) silver, respectively by powder X software. The full width-at-half-maximum (FWHM) values measured for (111) plane of reflection were used to determine the size of the nanoparticles using Debye–Scherrer equation. Fourier transform infrared spectroscopy (FTIR) spectrum showed the bands at 1651 and 1548 cm−1, identified as the amide-I and -II bands, arising due to carbonyl stretch and ---N---H stretch vibrations in the amide linkages of the proteins, respectively.

Environment 2

New Solid State Sensor for Detection of Humidity, Based On Ni, Co, Mn Oxides Nanocomposite

A. Kazemzadeh[*], F. A. Hesari, N. Jafari
Materials & Energy Research Centre, P.O.Box 14155-4777 Tehran-IRAN
[*] *Corresponding author: ASG642001@yahoo.com*

Abstract

Nano-metal oxides of Ni, Co, Mn were synthesized by wet chemical route. The Nanocomposite of Mn, Co, Ni were sintered at 600º C, and analyzed by atomic absorption spectroscopy, the micro pores of nanocomposite of Mn, Ni, Co were used to sense the humidity of atmosphere. The nanocomposite was subjected to atmosphere of different percentage of relative humidity at room temperature and then electrical conductivity of nanocomposite was measured. The sensitivity factor was >50000 in the range of 5-98 RH. A drastic decrease was observed in electrical resistivity as humidity increased. The techniques of FT-IR, TG, DTA, XRD, SEM and TEM were used to characterize the nanocomposite.

Keywords: Nanocomposite, Solid State, Synthesis, Element and Nanotechnology

Study of swift $^{8}O^{6+}$ ion irradiation modifications in lexan polycarbonate

S. Asad Ali[a,*], R. Kumar[b], A. H. Naqvi[a], F. Singh[c], P. K. Kulriya[c], R. Prasad[a,d]

[a] *Department of Applied Physics, Z. H. College of Engineering & Technology, Aligarh Muslim University, Aligarh-202002, India*

[b] *University School of Basic & Applied Sciences, Guru Gobind Singh Indraprastha University, Delhi-110403*

[c] *Inter-University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi -110067, India*

[d] *Vivekananda College of Technology and Management Aligarh-202002*

[*] *Corresponding author: asadapd@yahoo.com*

Abstract

Swift Heavy Ion (SHI) irradiation of the polymeric materials results into the modification of their physico-chemical properties due to the transfer of high value of energy by the heavy ions causing unusual density of electron hole pairs close to ion path [1]. Optical, chemical and structural changes induced by 95 MeV oxygen ions in LEXAN polycarbonate films are studied by UV-Visible (UV-Vis) spectroscopy, Fourier Transform Infra Red (FTIR) spectroscopy, and X-Ray Diffraction (XRD). Irradiation was carried out under high vacuum of the order of 4 x 10^{-6} Torr with oxygen ions from Pelletron accelerator at Inter University Accelerator Centre (IUAC), New Delhi, India to the fluences of 10^{10},10^{11}, 10^{12}, 10^{13} and 2 x 10^{13} ions/cm^2. A slight shift in the optical absorption edge towards the red end of the spectrum was observed with the increase in ion fluence. The optical band gap (E_g), calculated from the absorption edge of the UV-Vis spectra of these films in 200-800 nm region varied from 3.18 eV to 1.78 eV for virgin and irradiated samples. The cluster size varied in a range of 5 to 10 carbon atoms per cluster. In FTIR spectra, appreciable modification in terms of breaking of the cleavaged C-O bond of carbonate and formation of phenolic O-H bond was observed after irradiation. XRD analyses show significant change in crystallinity with fluence. A decrease of ~ 9.02% in crystallite size of irradiated sample at the fluence of 2x10^{13} ions/cm^2 was observed.

Nano scale free volume study of 70 MeV Carbon C^{5+} ion induced modification in CR-39 polycarbonate polymer by positron annihilation

R. Kumar[a,*], S. A. Ali[b], U. De[c], D. Das[d], R. Prasad[b,e]

[a] *University School of Basic & Applied Sciences, Guru Gobind Singh Indraprastha University, Delhi-110403, India*

[b] *Department of Applied Physics, Z. H. College of Engineering & Technology, Aligarh Muslim University, Aligarh-202002, India*

[c] *Variable Energy Cyclotron Centre, 1/AF, Bidhan Nagar, Kolkata-700064., India*

[d] *UGC-DAE Consortium for Scientific Research, Kolkata 700 098, India*

[c] *Vivekanand College of Technology and Management, Aligarh-202002, India*

[*] *Corresponding author: rajeshpositron@gmail.com*

Abstract

The bombardment of the polymeric materials with Swift Heavy Ions (SHI) results in the change of their free volume properties which have strong correlation with macroscopic properties of the polymeric material. CR-39 polycarbonates films (250 μm) were irradiated with C^{5+} ions of energy 70 MeV to the fluences of 10^{10} to 10^{13} ions/cm^2 from 15 UD Pelletron accelerator at Inter University Accelerator Centre (IUAC), New Delh, Indiai. The effect of ion irradiation on free volume and characterization by Positron Annihilation Lifetime Spectroscopy (PALS) have been studied. Observed lifetime spectra were resolved into three components and from o-Ps lifetime component associated with the pick off annihilation of positronium trapped in the free volume, mean free volume radius was obtained. o-Ps lifetime and therefore, the average free volume and fractional free volume are found to decrease with ion fluence.

Study of nanoscale voids and free volume property of 145 MeV Ne^{6+} ion induced in PES polymer by position annihilation lifetime studies

S. Asad Ali[a,*], Rajesh Kumar[b], Rajendra Prasad[c]

[a] *Department of Applied Physics, Z. H. College of Engineering & Technology, Aligarh, Muslim University, Aligarh-202002, India*

[b] *University School of Basic & Applied Sciences, Guru Gobind Singh Indraprastha University, Delhi-110403*

[c] *Vivekananda College of Technology and Management Aligarh-202002*

[*] *Corresponding author: asadapd@yahoo.com*

Abstract

Nano scale voids and free volume properties of polymeric materials changes with Swift Heavy Ion (SHI) irradiation. The irradiation of polymeric materials with Swift Heavy Ions (SHI) results into the change of their free volume properties which have strong correlation with their macroscopic properties. The availability of heavy ion beams from the accelerators has brought new impetus to the field of ion beam modification as dramatic modifications in polymeric materials have been observed. Positron Annihilation Lifetime Spectroscopy (PALS) has emerged as a unique and potent probe for characterizing the free volume properties of polymers [1, 2]. Polyethersulphone (PES) films of thickness (250 µm) were irradiated with Ne^{6+} ions of energy 145 MeV from Variable Energy Cyclotron, Kolkata to the fluences of 10^{10}, 10^{11} and 10^{12} ions/cm^2. Positron Annihilation Lifetime measurements were carried out at UGC-DAE Consortium for Scientific Research, Kolkata, India using fast- fast coincidence spectrometer (FWHM 295 ps). The positron lifetime spectroscopy data were analyzed by fitting three lifetime components. In PALS, it is the o-Ps lifetime (longest lived component) which is directly correlated to the free volume. The intensity of this component contains information about free volume hole concentration-Ps lifetime and, therefore, the average free volume and fractional free volume are found to change with fluence. With the increase in the flux, scissioned segments crosslink randomly, resulting into the decrease of average free volume due to overlapping of tracks. Results will be discussed.

Composite

Alignment of Carbon Nanotubes Using Magnetic Nanoparticles

S. Aldajah[a,*], Y. Haik[a,b], M. Alrawadeh[a]

[a] *Department of Mechanical Engineering, United Arab Emirates University, Al-Ain 17551, United Arab Emirates, E-mail address:*

[b] *Center for Research Excellence in Nanobiosciences, University of North Carolina-Greensboro, NC, USA*

[*] *Corresponding author: s.aldajah@uaeu.ac.ae*

Abstract

Carbon nanotubes are driving scientific research nowadays. This field has several important directions in basic research, including chemistry, electronic transport, mechanical and field emission properties. The most eye-catching features of carbon nanotubes are their electronic, mechanical, optical and chemical characteristics, which open a way to future applications. One of the most important applications of nanotubes based on their properties will be as reinforcements in composite materials. One of the biggest concerns to nanotube industry is the alignment problem which has limited the usage and utilizations of carbon nanotubes in composites. The ability to impose a preferred alignment of carbon nanotubes in a composite will increase the effectiveness of utilizing nanotubes in composite applications. The alignment of nanotubes will maximize the interfacial bonding across the nanotube matrix interface.

In this research, we developed a methodology and a process to align nanotubes in polymer nanocomposites by means of a magnetic field. By doing so, we will get a very strong nanocomposite that can be used in the automobile bumper industry.

Our proposed mechanism aims at aligning the carbon nanotubes by means of nanomagnetic particles that are adsorbed on the nanotube surfaces and by applying an external magnetic field. SEM analysis have shown that Nanomagnetic particles with the assistance of the magnetic filed were able to align the carbon nanotubes in the desired direction.

Keywords: Carbon nanotubes; Alignment; Nanocomposite; Nanoparticles.

Nano-scale bone-like apatite formation on the new resin-modified glass-ionomer cement

Jhamak Nourmohammadi*, S. K. Sadrnezhaad, A. Behnamghader
Material and Energy Research center, Tehran, Iran, P.O. Box: 14155-777
** Corresponding author: jnour@merc.ac.ir*

Abstract

Resin-modified glass-ionomer cements, which consist of calcium-fluoro alumino silicate glass powders and a water-compatible monomer usually hydroxyl-ethyl methacrylate (HEMA) together with a polyacrylic acid (PAA) and polymerization initiators, have been widely used in dentistry. They set rapidly without any shrinkage, the lack of temperature increase on reaction, and develop high mechanical strength. Therefore, if bioactive glass-ionomer cements can be obtained, such cements are expected to be useful as cements for fixing orthopedic implants to the surrounding bone. In the present study, the formation of nanocrystalline carbonated apatite on the surface of new resin-modified glass-ionomer cement via mimicking the physiological conditions has been investigated. Scanning electron microscopy (SEM), X-ray diffraction (XRD), Inductive couple plasma (ICP), Transmission electron microscopy (TEM) and EDS were employed to characterize the created nano-scale apatite. The results clearly show that the exposure of cured cement to Simulated body fluid (SBF) leading to precipitation of nano-scale needle-like apatite. It appears that the new cement suggests a potential use in orthopedic surgery.

Keywords: Resin-modified glass-ionomer cement, Nano-size apatite, Biomimetic, SBF

Synthesis of Al_2O_3-ZrO_2 nano-Compostie by sol-gel method using hydrated chlorides of Aluminum and Zirconium

A. Kazemzadeh[a], I. Mobasherpour[a,*], M. Solati Heshajin[b]

[a] *Ceramics Department, Materials and Energy Research Center, P.O. Box 31787-316, Tehran, Iran*

[b] *Biomaterials Engineering Department, Amir Kabir University of Tehran, Tehran, Iran*

[*] *Corresponding author: I_Mobasherpour@merc.ac.ir*

Abstract

In this research Al_2O_3-ZrO_2 nanocomposite has been synthesized by use of hydrated chlorides of Aluminum and Zirconium through the sol-gel process. Required quantity of zirconia sol was added to alumina gel, so that the final composite contains 30 wt.% zirconia. In order to study the structural evolution, the X-ray diffraction (XRD) and Simultaneous thermal analysis (STA) were used. Transmission electron microscopy (TEM) and Scanning electron microscopy (SEM) were used to estimate the particle size. The results of X-ray diffraction shows achieved indicate that both α- Al_2O_3 and ZrO_2 monoclinic phases are formed beside each other and produce a nano-composite structure by sol-gel technique from raw materials for first time. Differential thermal analysis shows, that the α-Al_2O_3 phase transformation temperature is higher for sample containing zirconia.

Keywords: Alumina-Zirconia, Nanocomposite, Sol-Gel Method

Phantom designing based on nano hydroxyapatite composite in a new bone mineral densitometry instrument

S. M. Eshaghi, A. Hossein-Nezhad*, B. Larijani

Bio & Nano Technology group, Endocrinology and metabolism research center, Tehran, Islamic Republic of Iran

* *Corresponding author*

Abstract

The purpose of the present study was to determine mandible bone mineral density and results compare based on using two kinds of phantoms. Two kind composites contain hydroxyapatite powders in micro or nano scale. Periapical radiographs were obtained with a constant current of 8 mA, 70 kVp, and 3 s exposure times, always from the same distance. Images were recorded by use of standard radiographic film. The calibration curve was drown, by plotting against the measured mean grey level values of each step on the step wedge phantom and those values of the measured mean grey level of digitized films. Its segment densities were measured with DXA and corrected with chemical content estimations. The mean grey levels were measured on each of the steps using dedicated software with a probe of 5x5 pixels. Measured GL values of each step on the step wedge phantom were plotted against the measured densities on the DXA to obtain a calibration curve. On the mandibular image, the mean GLs were measured on the step wedge phantom and the regions of interest.The plain x-ray films were scanned using a standard film digitizer. After the film digitized, the developed Matlab software was used to image processing. In 207 postmenopausal women central BMD was measured through DXA method. In each women periapical radiography performed in two regions of mandible. Prevalence of osteoporosis and osteopenia in one of regions in central DXA were 17.4% and 48.2% respectively. In osteoporotic patients bone loss in mandible BMD was more than central DXA (p=0.02). There was strong correlation between mandible and total femur BMD (p=0.001, r=0.78) when using of composite mixed from nano hydroxyapatite powder, inter assay and intra Coefficient of variance significantly lower than other (p=002) and its sensitivity more than another phantom especially when the T-score of central BMD was lower than -1.5. These result indicated that composite containing nano scale of hydroxyapatite by homogenous demonstration may be improve sensitivity of mandibular BMD. The main advantage of the proposed mandible BMD is to help clinicians make more accurate evaluation of Bone loss. Based on developed the suggested system a routine dental X-ray may be used to screen for bone loss.

Characterization and synthesis of ZnO/SiO_2 nanocomposite using ZnO nanoparticles

H. Zare Bidaki[a], V. Ahmadi[b,*], SH. Ahmadi[c]

[a] *Department of Nanomaterial Engineering, Tarbiat Modares University, Iran*

[b] *Department of Electrical Engineering, Tarbiat Modares University, Iran*

[c] *Department of Physics, Tarbiat Modares University, Iran*

[*] *Corresponding author: v_ahmadi@modares.ac.ir*

Abstract

In this research, we synthesize the ZnO/SiO_2 nanocomposite by adding ZnO nanoparticles (with average diameter: 12 nm) in SiO_2 matrix through sol-gel technique. X-ray diffraction, FTIR, photoluminescence, energy dispersive X-ray spectroscopy and scanning electron microscopy are used to characterize the structural and optical properties of the samples. Photoluminescence measurements of nanoparticles indicate that total intensity and the ratio of I_{green}/I_{UV} decrease after 60 days, and also, it is observed that we have a red shift of green band (543 nm to 572 nm) after some period of time (about 60 days). It is observed that the intensity of the ultraviolet (UV) photoluminescence from ZnO greatly enhances by capping of the nanoparticles into the SiO_2 matrix. This is due to the reduction of oxygen defect states in ZnO particle surface. Intensity and shape of photoluminescence spectra of nanocomposite is very stable and do not change even after a long time.

Keywords: Sol-gel, ZnO nanoparticle, SiO_2 matrix, Nanocomposite

Modeling the effect of the grain size on the mechanical behavior of ultrafine grained metallic structures

A. Abdul-Latif

Laboratoire de Mécanique, Matériaux et Modélisation (L3M) Université Paris 8, IUT de Tremblay, 93290 Tremblay-en-France, France

Corresponding author: aabdul@iu2t.univ-paris8.fr

Abstract

Based on a novel experimental methodology which aiming to obtain metallic materials of ultrafine grained (UFG) structures refinement process, modeling of the grain size effect on the overall nonlinear strain-stress behavior of face centered cubic (FCC) polycrystals is developed in this work. The experimental methodology consists to propose a two-step process where the bulk UFG aluminum is produced by a combination of powder metallurgy (PM) and dynamic severe plastic deformation (DSPD). Indeed, it is found that the aluminum produced by PM has practically an average grain size of 2 mm with equiaxed grains and isotropic crystallographic texture. DSPD is performed by impacting the bulk material initially produced by PM using an intermediate strain rate ranging from 1s-1 to 100s-1. The dynamic loading offers a remarkable scheme to have a new grain refinement process, which gives almost an average crystallite size of 500 nm. After impact, it is obviously shown that the grain/crystallite interiors are almost dislocation-free. Hence, the microstructure of the UFG strongly suggests that the recovery and/or recrystallization process takes place during the crushing process inducing therefore a dynamic recovery. Now, validated models deficiency seems to be one of the principal barriers to the common use of these materials. Thus, developing microstructurally based models permits to appropriately predict its mechanical behavior. In the other words, having detailed mechanical and microstructural characterization to establish a thorough understanding of microstructure-property-relationships of a given UFG materials represents a substantial and proper approach for developing a performing constitutive model by an established self-consistent approach. The grain size effect on the overall mechanical behavior is described by means of the local inelastic flow (local yield surface) and by means of the grain/matrix interaction law. This development can be verified, at least, up to the sub-micrometer materials ($d \geq 100$ nm), in which dislocations can glide through grains and pile-up at grain boundaries. Within the framework of small strain hypothesis, the elastic anisotropy of the grain and grain rotation will be neglected for the sake of simplicity. The elastic behavior, which is defined at granular level, is assumed to be isotropic, uniform and compressible. Microscopically, the heterogeneous inelastic deformation is determined through the slip theory. In addition, the granular elastic behavior and its heterogeneous distribution from grain to grain within a polycrystalline aggregate are taken into account. It is obviously recognized that the proposed model describes fairly well the effect of the grain size on the strain-stress behavior of the submicrometer polycrystal.

Synthesis and characterization of carbon nanotubes reinforced nanocomposites

M. A. Etman*, R. M. Rashad, M. K. Bedewy
EL-Ahram Higher Institute for Engineering& Technology
* *Corresponding author: mohamed _12etman@yahoo.com*

Abstract

An experimental program has been designed to synthesize and characterize CNTs reinforced metallic and polymeric matrix nanocomposites. Aluminum, PVC, PMMA, and PS, matrices have been adopted for this investigation. Mechanical properties of the nanocomposites were measured to evaluate the enhancement extent caused by the CNTs loading. Morphological studies were also carried out using both SEM, and TEM microscopy. The results revealed a remarkable enhancement of the strength and ductility of the matrix material though the loading percent of reasonably dispersed CNTs did not exceed 3 wt. % in the Al and 5 wt. % in the Polymer.

Keywords: CNTs; Nanocomposites; Mechanical Properties; SEM; TEM Microscopy

Energy

Electrochemical Properties of Multiwalled Carbon Nanotubes Filled with Manganese Oxide and Nickel Oxide Using Wet Chemical Method

Meisam Kiamahalleh[a], Suhairi Sata[a], Surani Buniran[b], Sharifi Zein[a,*]

[a] *Advanced Materials Research Centre (AMREC) SIRIM Berhad, Kulim Hi-Tech Park, Kulim, Malaysia*

[b] *Department of Chemical Engineering, Universiti Sains Malaysia, 14300 Nibong Tebal, Pulau Pinang, Malaysia*

[*] *Corresponding author: chhussein@eng.usm.my*

Abstract

Manganese oxide (MnO_x) and nickel oxide (NiO_x)/ multiwalled carbon nanotubes (MWCNTs) nanocomposites for supercapacitor electrodes have been synthesized by chemical reduction method using acid treated MWNTs and respective salts. MWCNTs used in this study were produced by catalytic decomposition of methane using Ni/TiO_2 based catalyst. Structural and morphological characterizations of metal oxide dispersed MWNTs have been carried out using powder X-ray diffraction (XRD), transmission electron microscopy (TEM). Electrochemical performance of these electrodes has been investigated on aqueous electrolytic supercapacitor using cyclic voltammetry, galvanostatic charge-discharge. Specific capacitance of MnO_x and NiO_x filled MWNT electrodes increases compared to that pure MWNTs electrode due to the pseudocapacitance of the metal oxides nanoparticles encapsulated in MWNTs. The cycle life of these electrodes was also very stable for thousand of cycles.

Keywords: supercapacitor, nanocomposites, specific capacitance: metal oxides

Nanotechnology's Applications in Integrated Oil and Gas Reservoir Management: Concepts and Approaches

N. Nikkam[a,*], M. Ardjmand[b], A. Vatani[c], S. Amiri[a]
[a] *Iran Nanotechnology Initiative Council*
[b] *Islamic Azad University, Tehran South Branch, Tehran Iran*
[c] *Faculty of Chemical Engineering, University of Teheran*
[*] *Corresponding author: n_nikkam@yahoo.com*

Abstract

In the present study nanotechnology's applications in integrated oil and gas reservoir management have been studied. Generally; the main objective of the reservoir management is the application of optimal method of oil and gas recovery technique to increase the economical profitability of the production. This needs both operational and developmental considerations, including: decrease of risk and hazard probability, increase in oil and gas production, increase in recovery factor of oil and gas, minimization of operational and capital costs, conservation of reservoir production potency and…. The effective factors on the reservoir management includes: 1. technology, 2. data, 3. people and 4. tool factors which are divided into subcategories as shown in the following figure. Considering the integrational effects of these parameters for an optimal production of oil and gas from a known reservoir during the whole recovery periods is the main challenge of Integrated Reservoir Management (IRM).

Keywords: Nanotechnology, Oil Reservoir, Gas Reservoir, Integrated Reservoir Management

Influence of electrophoretically assembeled nanoparticles pattern on the heat transfer of colloidal suspensions

M. Chiesa[a,*], A. Schmidt[a,b], G. Chen[b]

[a] *Program of Material Science, Masdar Institute of Science & Technology, Abu Dhabi, United Arab Emirates*

[b] *Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, USA*

[*] *Corresponding author: mchiesa@MIT.EDU*

Abstract

Our study presents the results of an ongoing investigation of the thermal transport behaviour of colloidal suspension under the effect of Electric field. DC and AC electric fields are applied to the suspensions leading to the polarization of the particles. The interaction of the induced dipoles with the gradient of the applied field causes dielectrophoretic forces between the particles. These forces have the effect of aligning the particles in the direction of the applied field. This allows the study of the heat transfer in ordered suspension providing an indication of the impact of controlled anisotropy on the heat transfer behaviour. A pump-probe optical technique is employed for measuring the thermal conductivity of the colloidal suspension under the effect of an electric field. Our technique uses a reflective geometry, which does not depend on the optical properties of the suspension and requires as little as a single droplet to produce a result.

Keywords: Colloidal suspension, nanofluids, dielectrophoretic forces, pump and probe

Catalyst for Direct Methanol Fuel Cell Using with Platinum Nanoparticles

Sajjad Sadaghat Sharehjini[a,*], Mohammad Yar[b], Omid Moradi[a]
[a] *Islamic Azad University, Shahryar Shahr -e-Qods Branch Tehran, Iran*
[b] *Islamic Azad University, Eslamshahr Branch, Tehran, Iran*
[*] *Corresponding author: sajjadsedaghat@yahoo.com*

Abstract

Deposition of Pt nanoparticles by the order of 1-2.5 nm on carbon nanotubes (CNTs) (70 % Single Wall and 30 % Multi Wall) prepared by chemically anchoring Pt onto the surface of the CNTs in two steps: first refluxing CNTs in 70 % HNO3 at 120° C for 5 hr to remove amorphous carbonaceous impurities then slow oxidation of CNTs surfaces with 2.0 M HNO3 by refluxing for 10 hr to introduce surface functional groups. The nanoparticles of Pt are synthesized by reduction with sodium borohydride of H2PtCl6 in a 5.5 buffer solution of sodium citrate; the complexation of citrate with metal ions is beneficial to the formation of small particles.

For comparison, a Pt/XC-72 nanocomposite was also prepared by this method. A typical Pt loading of 50μg cm−2 is achieved, that shows higher specific surface area of Pt than an E-TEK electrode with Pt loading of 75 μg cm−2. TEM images show that the Pt particle size is in the range of 1-2.5 nm with a peak at 1.8 nm. The electro-oxidation of liquid methanol of this catalyst as a thin layer on glassy carbon electrode is investigated at room temperature by cyclic voltammetry.

Keywords: Carbon nanotubes; Fuel Cell; Nanoparticles ; Pt/XC-72 ; TEM images

New Ce^{3+} doped zinc magnesium aluminate nanophosphor for scintillator

M. S. K. Khokhar[a,*], Abhay D. Deshmukh[b], S. J. Dhoble[c], R. S. Kher[d], Animesh Kumar[e], D. R. Peshwe[b]

[a] *Department of Rural Technology, Guru Ghasidas University, Bilaspur 495 009, India*
[b] *Department of Metallurgical and Materials Engineering, VNIT, Nagpur- 440 011, India*
[c] *Kamla Nehru College, Sakkardara Square, Nagpur- 440 009, India*
[d] *Department of Physics, Government Science P. G. College, Bilaspur 495 006, India*
[e] *National Environmental Engineering Research Institute Nagpur-440020, India*
[*] *Corresponding author*

Abstract

Optical properties of Ce-doped compounds have been widely investigated. There is great interest in Ce^{3+} doped compounds or crystals for applications as phosphors, scintillators and tunable lasers [1–3]. It is well established that most Ce^{3+} activated phosphors show broad band emission in the UV and visible ranges due to the $4f^0 5d^1 – 4f^1$ transition of Ce^{3+} [1,4] and that their luminescence decays are fast. Usually, the trivalent cerium ion Ce^{3+} with the electronic configuration $4f^1$ has $2F_{7/2}$ and $2F_{5/2}$ manifolds as the ground states separated by 2000 cm^{-1} due to spin–orbit coupling. The lower manifold $2F_{5/2}$ is populated and the manifold $2F_{7/2}$ is almost empty at room temperature. The excited configuration is 5d which is split by the crystal-field in 2–5 components. As the positions of the energy levels of 5d excited states of Ce^{3+} are not only affected by the symmetry and strength of the crystal-field but also by the degree of covalent bonding, it causes variations in the absorption and emission from UV to long-wavelength by varying the host lattice [1].

New $ZnMgAl_{10}O_{17}$ doped with rare-earth Ce ion was synthesized by the combustion method and are characterized by XRD, SEM, EDS, particle size analyzer and photoluminescence measurements are reported first time in this paper. XRD characterization shows the crystalline nature of the phosphor. SEM characterization shows the particle size is 160nm. Particle size analyzer shows the particle size varying from 100nm to 1µm. Their excitation spectra all have a broadband center at about 254nm. In this system, a Ce^{3+} ion shows efficient broad band emission from 350-500nm peaking at 381nm and 425 nm due to the transition (350–450 nm) $5D–2F_{5/2,\ 7/2}$ of Ce^{3+} ion. The Ce^{3+} has a $4f^1$ electron configuration. Its emission is due to electron transition from the lowest crystal field splitting component 5D to the ground state $4f^1$ (split into $2F_{5/2}$ and $2F_{7/2}$ two components due to spin-orbit coupling). The PL characterization of $ZnMgAl_{10}O_{17}$: Ce^{3+} nanophosphor shows the emission of Ce^{3+} ion is useful for scintillators.

Keywords: Phosphor, aluminate, nanophosphor

Nanomaterials for Renewable Energy, Case Study: Hydrogen Storage Materials

M. Bououdina

University of Bahrain, College of Science, Department of Physics, PO Box 32038, Kingdom of Bahrain

[*] *Corresponding author: mboudina@sci.uob.bh*

Abstract

Hydrogen the most abundant element in the universe is very promising as clean and renewable energy resource. Its use will improve significantly air quality, health as well as prevents global warming, caused by fossil fuels. Hydrogen have been stored as pressurized gas (high pressures vessels and risk of explosion) and as liquid using cryogenic vessels (energy of liquefaction, leaks), and solid storage as metal hydrides (high density, reversible, safe). Depending on the type of the technological application (stationary, mobile, etc), the thermodynamic properties must be optimized: H_2 storage capacity, dissociation temperature and plateau pressure (related with Van't Hoff equation), kinetics in solid-gas or/and alkaline solution, cycling, etc.

It is found that the preparation of materials at the nanoscale induces a great impact on the H_2 storage and thermodynamic properties, including an increase in the kinetics of hydrogenation/dehydrogenation and lowering the hydrogen release temperature. In this review paper, many systems will be presented including Metal Hydrides ($LaNi_5$, FeTi, Laves Phases Compounds, Mg-based System, etc), Carbon Nanostructures, and Light Complex Hydrides.

Keywords: Nanomaterials; Hydrogen; Thermodynamics; Light Complex Hydrides; Carbon Nanostructures

Characterization

Laser speckle interferometry for detecting nano-biomaterials Particle Size and Particle Size Distribution

Hatem Mahmoud El Ghandoor*, Eman Ahmed Abd El Ghafar
Physics Department, Faculty of Science
Ain Shams University, Cairo- Egypt
* *Corresponding author*: *helghandoor@hotmail.com*

Abstract

Even the cleanest environments in the world are contaminated by nanoparticles; these are the product, not of the nascent nanotechnology industry, but of natural processes. A significant numbers of particles in the 10nm - 100 nm size range can be detected in biological tissues. When a coherent light beam is allowed to be incident on an optical rough surface it will scattered randomly through all directions in the form of Huggen's wavelets. Interference of these wavelets leads to the formation of a bright and dark spots; these were called "Laser Speckles. Speckle size is essentially controlled by the aperture size of the recording camera, no speckle smaller that 1/2 of the wavelength of the radiation can be recorded. When laser speckle is used, the wavelength of the laser beam, the f/number of the recording lens and magnification of the system determines how small the laser speckles can be generated.

In Double-Aperture Speckle Interferometry two speckle patterns are combined coherently to produce a third speckle pattern containing a grid lines run perpendicular to a line joining the apertures centers, each grid corresponds to displacement up to 0.1 or 100 nm. Speckle interferometry method is limited to displacements smaller than the diameter of one speckle grain .A significant numbers of particles in the 10nm - 100 nm size ranges can be detected in using speckle interferometry technique .We have successfully created speckles nanometre and applied them precisely for detecting nano-biomaterials particle size and particle size distribution before and after deformation caused by an external effect. The sensitivity of the interferometer can be changed by varying the angle of incidence θ on the double aperture interferometer, and the diameter of the double apertures.

This dynamic light scattering speckle interferometry technique can be executed through the following steps 1**:** Measure the Temporal fluctuations in intensity of scattered light (wavelength and angle are set by instrument; refractive index is input or assumed), then establish the correlation function and solve for the diffusion constant. Then using the Stokes-Einstein relationship to solve for the particle radius, and then use the autocorrelation data to obtain density distribution information, and deformation.

Keywords: Speckle Interferometry; Nanospeckles; Nanoparticles; Bio-speckles

Structural and magnetic properties of $Co_{0.5}Cd_xFe_{2.5-x}O_4$ ($0.0 \leq X \leq 0.5$) ferrite

Khalid Mujasam Batoo[a,*], Alimuddin[b], Shalendra Kumar[b]

[a] *Department of Applied Physics, Aligarh Muslim University, Aligarh-202002, India*

[b] *School of Nano and Advanced Materials Engineering, Changwon National University, South Korea*

[*] *Corresponding author: Khalid.mujasam@gmail.com*

Abstract

In the present work, we have studied the effect of non-magnetic Cd ions substitution on the magnetic propertied of $Co_{0.5}Cd_xFe_{2.5-x}O_4$ ($0.0 \leq x \leq 0.5$) using Mössbauer spectroscopy at 78 K. From the analysis of the Mössbauer spectra, it is found that the hyperfine magnetic field decreases at A and B site with increase in the value of the doping of Cd ions. The appearance of the paramagnetic doublet at x = 0.5, clearly indicates that A-B super-exchange decreases due to dilution of the sublattice by Cd ions. The value of the isomer shift values observed from the fitting of the Mossbauer spectra clearly indicates that that the resolve sextets in studied samples are due to Fe^{3+} ions only i.e. iron is in Fe^{3+} state.

Mechanical Properties and Microstructure of the Carbon Nanotube-Hydroxyapatite Composites

M. Zardkuhi*, E. Salahi, A. Kazemzadeh
Materials and Energy Research center, Karaj, Iran
** Corresponding author: maysamzardkuhi@yahoo.com*

Abstract

Carbon nanotube-reinforced hydroxyapatite composites were made in this research. After synthesizing hydroxyapatite through a co precipitation process, it was tried to make stable suspensions of hydroxyapatite and carbon nanotubes, the mixing of which would give a stable suspension of both hydroxyapatite particles and carbon nanotubes. Evaporation of this suspension's solvent led to the sedimentation of hydroxyapatite and carbon nanotube mixture, in a way that carbon nanotubes were evenly dispersed among hydroxyapatite particles and a homogeneous mixture was achieved. Finally the resulted composite powder including different amounts of carbon nanotubes, which were molded by pressing and heating in the same time under different pressures, were pressure less sintered at 1100°C under nitrogen atmosphere, and finally the mechanical properties including flexural strength and fracture toughness of the composites were investigated and compared to those of monolithic hydroxyapatite.

Keywords: Hydroxyapatite, Carbon nanotubes, Ceramic matrix composites

Influence of grain size and temperature on electromagnetic properties of nanocrystalline ferrites

Khalid Mujasam Batoo[a,*], Alimuddin[b], Shalendra Kumar[b]

[a] *Department of Applied Physics, Aligarh Muslim University, Aligarh-202002, India*

[b] *School of Nano and Advanced Materials Engineering, Changwon National University, South Korea*

[*] *Corresponding author: Khalid.mujasam@gmail.com*

Abstract

Electrical conductivity and dielectric measurements have been investigated for nanocrystalline ferrites with general formula $Ni_{0.2}Cd_{0.3}Fe_{2.5-x}Al_xO_4$ ($0.0 \leq x \leq 0.5$) for four different average grain sizes ranging from 3 to 7 nm. The complex impedance spectroscopy has been used to study the effect of the grain and grain boundary of the Al doped nanocrystalline Ni-Cd ferrites. The analysis of data shows only one semi-circle corresponding to the grain boundary volume suggesting that the conduction mechanism takes place predominantly through grain boundary volume in the studied ferrite. The variation of impedance properties with respect to temperature and composition has been explained using the Cole-Cole expression, in the frequency range of 120Hz-5MHz between the temperatures 300-473K. The variation of activation energy with grain size has been reported in this paper. The ac conductivity and dielectric loss (tanδ) both show a normal behaviour with frequency. The dielectric constant and loss tangent (tanδ) are found to decrease with increasing frequency, whereas they increase with increasing temperature. The dielectric constant shows an anomalous behaviour with the temperature, which has been explained on the basis of Rezlescu model. Ac susceptibility measurements show that the blocking temperature decreases with the Al doping. The variation of blocking temperature in the real and imaginary part of ac susceptibility shows the existence of non-linear phase.

Steady-state photoluminescence and nanostructural properties of porous silicon

Adwan Al-Ajili
Department of Physics, College of Science, Al-Imam Mohammed Bin Saud Islamic University, Riyadh, Kingdom of Saudi Arabia

Abstract

The photoluminescence (PL) emitted by porous silicon has been investigated by using continuous tuneable UV synchrotron source at Daresbury Laboratory in the UK. A group of samples have been investigated for a range of PL emission wavelength red to green, at temperatures 77-295 K. The PL peak is found to shift to higher frequency with decreasing temperature. Information about the nanostructure of porous silicon have been determined from PL and EXAFS, as well as from electron microscopy. In particular the optical properties of the silicon-based nanostructured materials, obtained from PL and photoluminescence excitation (PLE) measurements, have been correlated with structural information from Si K-edge EXAFS taken at Daresbury Laboratory. Electron microscopy was used to study the relation between the nanostructure and PL of porous Si, and to investigate porous Si structure. The samples had different PL spectra and were expected to have different nanostructures. Platelet Si and Si crystallites in porous Si layers were observed in all samples. The size of crystallites ranged from 4 - 10 nm. Diffraction patterns show these porous Si samples have a crystalline structure.

Field Emission Study of Selenium-Tellurium nanomaterials grown by thermal evaporation

M. A. Majeed Khan*, M. Husain, M. Zulfequar
Department of Physics, Jamia Millia Islamia, New Delhi-110025, India
** Corresponding author*

Abstract

Using thermal evaporation Se-Te nanomaterials thin films were deposited on glass substrates in presence of oxygen mixed with argon. The properties of Se-Te thin films strongly depend on the deposition method. During this process the substrate is cooled to a temperature of 77 K using liquid nitrogen. The surface morphology of the glass as-deposited films was investigated via scanning electron microscopy (SEM). The typical size of these nanomaterials is in the range of 40-80 nm and length is 2-4 μm respectively. Electrical transport measurements of these nanomaterials are studied over a temperature range of 280-390 K. The density of states at Fermi level $N(E_F)$, hopping distance (R), hopping energy (W) have been calculated using Mott's model.

Keywords: Nanomaterials, Electrical transport, Scanning Electron Microscope (SEM), thermal evaporation process

Fabrication

Nano-Analytics for technically relevant Nano-Coatings: Chemical Force Microscopy in application

Sabri Akari*, Michael Korte, Harald Kuehn
Company NanoCraft, Turmstr. 4, D-78234 Engen, Germany
Corresponding author: akari@nanocraft.de

Abstract

Surface chemical properties of Nano-Coatings are playing the main part in defining the functionality of the surface properties to be achieved. The functionality of the used molecules depend on their actual distribution, confirmation and alignment on the surface. The main property “adhesion” is not always as wished, the fact which is extending developing time strongly.

In this presentation a convenient Nano-Technical analytical tool “chemical force Microscopy” will be introduced to achieve a better molecular understanding to relevant surface and chemical processes on the surface. The molecular distribution as well as adhesion forces can be precisely analyzed. Different application fields will be demonstrated.

Keywords: Nanoatings; Nano Analytics; ultra thin films; Chemical Force Microscopy; Scanning Force Microscopy

The effect of electroplating parameters on the morphology and wear behavior of pulse electrodeposited nanostructured Ni-Al_2O_3 coatings

S. M. Lari[a], A. Amadeh[a], H. Moradi[b]

[a] *School of Metallurgy and Materials Engineering, Faculty of Engineering, University of Tehan, P.O.Box 11155-4563, Tehran, Iran*

[b] *Maham Industries, Tehran, Iran*

Corresoponding author: amadeh@ut.ac.ir

Abstract

Electroplating is one of the appropriate methods for co-deposition of fine metallic, non-metallic and polymeric particles in metal matrix coatings. In this study, nanostructured nickel-Alumina composite coatings were electrodeposited using a square shaped pulse current. The effect of electroplating parameters such as current density, duty cycle, pulse frequency and pH on the distribution of nano-ceramic particles as well as the wear resistance of the coatings was investigated. The results showed that a decrease in current density and duty cycle led to more incorporation of alumina particles and increased the wear resistance of the coating. An increase in pulse frequency up to 100 Hz resulted in a reduction in co-deposition of particles, while, beyond 100 Hz led to an increase in alumina content of the coating. The optimum wear resistance has been achieved at 10 Hz frequency.

An investigation on the effect of temperature and PH on the distribution of nano-sized alumina in pulse electrodeposited NI-Al_2O_3 nano-composite coatings

S. M. Lari[a,*], A. Amadeh[b], H. Moradi[c]

[a] *School of Metallurgy and Materials Engineering, University Colledge of Engineering, University of Tehran. P. O. Box 11365-4563, Tehran, Iran*

[b] *School of Metallurgy and Materials Engineering, University Colledge of Engineering, University of Tehran. P. O. Box 11365-4563, Tehran, Iran*

[c] *Maham Industries, Tehran, Iran*

[*] *Corrsponding author: Mohlari2005@yahoo.com*

Abstract

Electroplating is one of the appropriate methods for co-deposition of fine metallic, non-metallic and polymer particles. Appropriate electrolyte pH and temperature would be needed to control the agglomeration of ceramic particles. In this research, nano-composite Ni-Al2O3 coating has been electrodeposited from an alumina containing Watts bath using square pulse current. The effect of pH and temperature on the embedment of nano-alumina particles in the coating, as well as its wear behavior was investigated. The results showed that the distribution of ceramic particles became more uniform by decreasing the electrolyte pH. Also, the optimum distribution of alumina particles and wear properties were achieved at 50oC and pH = 4.5.

Fabrication of STM W nanotip by electrochemical etching method

Gh. Tahmasebipour[a], V. Ahmadi[b,*], A. Abdulla[c], Y. Hojjat[a]

[a] *Department of Mech. Engineering, Tarbiat Modares University, Tehran, Iran*

[b] *Department of Elect. Engineering, Tarbiat Modares University, Tehran, Iran*

[c] *Department of Mech. Engineering, Amirkabir University of Technology, Tehran, Iran*

[*] *Corresponding author, Email:* v_ahmadi@modares.ac.ir

Abstract

With developments in nanoscience and nanotechnology, Scanning Tunneling Microscope (STM) has found a wide application in imaging the atoms, molecules, and nanostructures. This microscope uses an ultra sharp metallic tip for scanning sample surface to produce surface topographic image with atomic resolution. Reliability and resolution of STM images depend largely on the sharpness of the tip apex and repeatability of images depends on mechanical strength of tip material. During last decades, a variety of techniques and processes have been developed for fabrication of different metallic tips made from tungsten, platinum, platinum-iridium, gold, and silver. Electrochemical etching process is the most popular method for fabrication of nanotips with desired quality, reliability, and reproducibility and tungsten is normally the first choice for fabrication of STM tips as it has a high mechanical strength as well as a good electrical conductivity. Fabrication of STM tungsten tip by using electrochemical etching method and tip characterization has been the subject of several researches. Nevertheless, to our knowledge, effects of electrolyte type, tungsten wire diameter, cathode material, voltage type (AC/DC), automatic monitoring of process, perpendicularity of wire toward electrolyte surface, and environmental vibrations on the tip shape and sharpness have not been studied so far. In this paper, effects of these parameters on the tip shape and sharpness are investigated. A proper set-up for STM tungsten nanotip fabrication by using electrochemical etching method is presented. Some of the results found in this research are:

The nanotips fabricated by using the KOH electrolyte have higher sharpness in comparison with the nanotips fabricated by using NaOH electrolyte.

With decrease of tungsten wire diameter, the sharpness of the nanotip apex increases.

The nanotips fabricated by using a conductive cathode material with higher electrical resistance (e.g. porous graphite) have higher sharpness compared to a cathode material with lower electrical resistance (e.g. steel).

The nanotips fabricated under DC bias have apex of hyperbolic shape with high sharpness while those fabricated under AC voltage have conic form apex with low sharpness.

Keywords: Scanning Tunneling Microscope (STM), Nano-tip, electrochemical etching method

Synthesis and Characterization

Synthesis and characterization of ZnO nanorods and nanowires using PVP as capping

M. Skandari[a], V. Ahmadi[b,*], SH. Ahmadi[c]

[a] *Department of Nanomaterial Engineering, Tarbiat Modares University, Iran*

[b] *Department of Electrical Engineering, Tarbiat Modares University, Iran*

[c] *Department of Physics, Tarbiat Modares University, Iran*

[*] *Corresponding author: v_ahmadi@modares.ac.ir*

Abstract

Nanostructured materials have expected increasing attention due to their potential applications as active components or interconnect in nanoscaled electronic, optical, optoelectronic, electrochemical, and electromechanical devices [1]. It has a wide direct band gap (3.37 eV), large exciton binding energy (60 meV), excellent chemical, mechanical, and thermal stability, and biocompatibility [2].

In this study, ZnO nanowires are synthesized via ZnO nanorods at low-temperature by using zinc acetate dehydrate and polyvinyl pyrrolidone (PVP) as precursor and capping, respectively. We used of chemical solution method for synthesis of ZnO nanowires. Samples are characterized by means of scanning electron microscopy (SEM) and X-ray diffraction (XRD). First, the nanorods are prepared at 300^0C temperature, and then they are put into the furnace without special atmosphere at 450^0C for 2h. It is observed that nanowires with 20nm diameter are produced. Photoluminescence spectra of nanorods and nanowires are compared. It shows that intensity of ultraviolet peak in the nanowires decreases but in contrast the intensity of green emission part increases. This is because, the surface effects such as oxygen vacancies increase in the structures of ZnO.

Keywords: nanorods, nanowires, ZnO, PVP, PL

Fabrication and Evaluation of Human Serum Albumin (HSA) Nanoparticles for Drug Delivery Application

R. Mehravar[a], M. Jahanshahi[b,*], N. Saghatoleslami[a], P. Golbayani[b]

[a] *Faculty of Chemical Engineering, Ferdowsi University, Mashhad, Iran*

[b] *Nanobiotechnology Research Lab, Faculty of Chemical Engineering, Babol University of Technology, Babol, Iran*

[*] *Corresponding author: Mjahan@nit.ac.ir*

Abstract

Human Serum Albumin (HSA) Nanoparticles represent promising drug carrier systems. Particle size is a crucial parameter in particular for the in vivo behavior of nanoparticles after intravenous injection. The object of present study was to characterize the desolvation process of human serum albumin for the preparation of nanoparticles. Several process parameters were examined to achieve a suitable size of nanoparticles such as pH. The nanoparticle sample was purified by five cycles centrifugation (20000×g, 8 min) and redispersion of the pellet to the original volume water at pH values of 6 to 9 respectively and then analyzed by PCS.

Keywords: Human serum albumumin, Nanoparticles, Drug delivery, Desolvation method

SnO Semi Conductive Nano Powder-Part I: Synthesis and Characterization

M. Morshediyan Rad[a,*], O. Moradi[b], S. S. Sharehjini[c]

[a] *Faculty of Physical, Ghom Branch, Islamic Azad University, Ghom, Iran*

[b] *Physical Chemistry Laboratory, Islamic Azad University, Shahriyar-Shahre-e Ghods Branch, Tehran, Iran*

[c] *Department of chemistry, Shahid Behashti University, Tehran, Iran*

[*] *Corresponding author: m25mr@yahoo.com*

Abstract

In this research, SnO semi conductive nano powder was successfully synthesized using a chemistry aqueous-solution method. Materials used for this synthesis are: $SnCl_2$, HCl and NH_4OH.

Applying variations on pH of the solution etc, we obtained various products which were different in size. X-ray for characterizing the products has been used. The major advantage of this work is reaching the particles of size 30-100 nm using chemistry aqueous-solution method.

SnO Semi Conductive Nano Powder-Part II: Study of its Optical Absorption Properties

Majid Morshediyan Rad[a,*], Parviz Boroojerdian[a], Omid Moradi[b], Monir Kamalian[a]

[a] Faculty of Physical, Ghom Branch, Islamic Azad University, Ghom, Iran

[b] Physical Chemistry Laboratory, Islamic Azad University, Shahriyar-Shahre-e Ghods Branch, Tehran, Iran

[*] Corresponding author: m25mr@yahoo.com

Abstract

In this paper, nanoparticles of tin monoxide (SnO) had been synthesized by two ways: hydrothermal process and microwave solution; from the reaction of $SnCl_2.2H_2O$ precursor with HCl and NH_4OH. After synthesis, samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDAX) and UV-Vis spectrophotometry. In samples synthesized by hydrothermal and microwave solutions, the size of particles were 25 and 19 nm, respectively. The indirect band gap of SnO was calculated from the optical spectra to be 3.21eV; but it's known that the value of its band gap is of 2.5-3 eV.

Keywords: Nanoparticle; Tin monoxide; UV-Vis; Optical absorption; Band gap

Influence of Thermal Oxidation Treatment on Optoelectronic Device Characteristics

Alwan M. Alwan[a], Narges Z. Abd alzahr[a], N. M. Ahmed[b,*], N. H. A. Halim[b]

[a] School of Applied sciences, university of Technology, Baghdad, Iraq

[b] Microelectronic Engineering School, University Malaysia Perlis, Jejawi, Arau, 02600, Kangar, Malaysia

[*] Corresponding author: naser@unimap.edu.my

Abstract

The morphology properties of the freshly and oxidized porous silicon at oxidation time (60 ,90- sec)was studied .A blue emission from PSi can see with eyes after thermal oxidation because increase energy gab due to decrease silicon column (nano particles).Pore size and shape of n-type wafers are estimated and correlated to the optical properties before and after rapid thermal oxidation (RTO).

Keywords: porous silicon, oxidation, optical properties

New Chemical Sol-Gel Process (CVD) Synthesis of Carbon Nanotubes with Palladium Do pant for sensing

A. Kazemzadeh*, N. Jafari
Materials & Energy Research Center, Tehran, P.O. Box 14155-4777- IRAN
** Corresponding author: Asg642001@yahoo.com*

Abstract

This work deals with. Support and catalyst materials have been proved to be critical to scalable chemical vapor deposition (CVD) synthesis of carbon nanotubes. In own study, we found that porous Al_2O_3, SiO2 prepared by sol-gel process of its organosilane compound and salts was an eminent support for CVD growth of carbon nanotubes. The quality of as-grown ($SWAT_S$). On Al_2O_3, SiO2 support and Fe, MO catalyst was stable; the effect of reaction condition such as furnace temperature, flow rate, of the gas and type of catalysts and supports on the properties of as ($SWNT_S$). Products were thoroughly investigated and characterize by TEM, SEM, C-V, I-V, Band Gap, Hall effect, XRD, Raman Spectroscopy and technologies. The results indicated that the yields of carbon nanotubes on Al_2O_3, SiO_2.With Fe and MO could be up to about75%. The obtained purify of the as growth product was higher than 85% after treatment with HCl, HNO3 and HF.An innovative hydrogen sensor based on palladium nanoparticle is describe in carbon nanotubes. Sensor has a low cost, fast response time and range of sensitivities complies with the requirements that one would except for a reliable hydrogen sensor.

Keywords: Carbon Nanotube, CVD Synthesis, Hydrogen and Sensor

Synthesis, Fabrication

High Frequency Probe for Characterization of Magnetic Structures

Ra'a A. Said
Institute of Applied Technology, United Arab Emirates
Corresponding author: raa.said@iat.ac.ae

Abstract

The development of technology is happening at an increasingly faster pace and is resulting in reduced devices dimensions reaching the sub-micron range, and an increased operating speed. However, the successful operation of such devices requires suitable diagnostics tools. In the sub-micron regime, only non-invasive (non-contact) diagnostics tools can provide reliable results. The work presented here involves the design and fabrication of a probing stage, shown in Fig. 1(a) and 1(b), for the characterization of magnetic properties of sub-micron structures. The heart of the probing stage is a micro-induction wire probe capable of non-contact high frequency measurement of magnetic fields. The probe consists of a micro-wire from a ferromagnetic material with copper micro-wire wounded in the form of a coil, as shown in the schematic illustration in Fig. 1(c). The magnetic filed lines, emanating from currents at nodes within an integrated circuit or a magnetic particle for example, will flow through the ferromagnetic wire, thus inducing a proportional current in the coil turns. Upon the detection of the induced current, the actual current in the circuit or the magnetic properties of the particle can be extracted. To allow for high frequency operation of the probe, the wire probe is attached to the end of a co-planar feed structure. The probe can be used to measure magnetic properties of sub-micron magnetic particles through modulation of the separation between the probe tip and the particle. Also, the probe has the capability to influence magnetic particles if driven with proper electrical signal. A demonstration of the probe operation of will be presented through non-contact measurement of electric current passing through a printed transmission line.

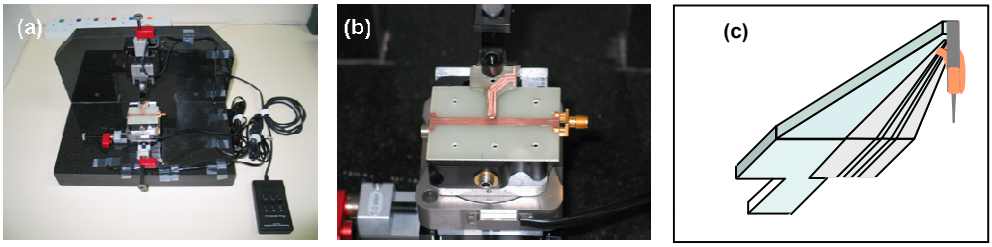


Fig. 1: Photographs of: (a) the mechanical stage and assembly, (b) the probe over a device under test, (c) A Schematic illustration of the proposed micro-wire probe

Keywords: High frequency probes; wire probes; magnetic characterization.

Phenomenon of Nanowires Growth on Bi-Mn-O System During Milling Process

B. W. Wahyu[a,*], S. W. Agus[b], Y. F. Erfin[a], T. R. Nurul[a]
[a] *Research Center for Physics, Indonesian Institute of Sciences*
[b] *Graduate School of Engineering, Kagoshima University, Japan*
Corresponding author: wahyubw@gmail.com

Abstract

The mechanism of nanowires growth during milling process is a new phenomenon which has not been studied intensively. This paper discuss the growth phenomenon of bismuth oxide nanowires during milling process of Bi-Mn system. Milling process was committed on the mixture of Bi and Mn powder of composition of Bi-50at%Mn using High Energy Milling E3D (HEM E3D) made by Research Center for Physics, LIPI in argon atmosphere for 1, 4, 8, 16, 32, and 64 hours. The obtained powder samples were then characterized using X-Ray Diffractometer and ESEM. The X-Ray diffraction pattern showed evolution and formation of new phase which followed the occurrence of nano sized wire-like geometry as shown by microstructural photograph of ESEM. The analysis of milling product showed The critical time when the nanowires geometry started to occur and to vanish due to continuous impact during milling process.

Preparation and characterization of nanostructured tungsten oxide electrochromic layer by sol-gel method

M. Fattah Hesari[a], V. Ahmadi[b,*], SH. Ahmadi[c]

[a] *Department of Nanomaterial Engineering, Tarbiat Modares University, Tehran, Iran*

[b] *Department of Electrical Engineering, Tarbiat Modares University, Tehran, Iran*

[c] *Department of Physics, Tarbiat Modares University, Tehran, Iran*

[*] *Corresponding author: v_ahmadi@modares.ac.ir*

Abstract

Tungsten oxide (WO_3) is one of the most promising materials for electrochromic devices. In this paper we report on nanostructured WO_3 thin films prepared by sol-gel method. The WO_3 sol is prepared from tungsten hexachloride precursor with and without addition of 4% w oxalic acid dihydrate (OAD). The structure and the stoichiometry of films deposited by spin coating technique, on indium tin oxide (ITO) coated glass substrates, are studied by XRD. Scanning electron microscopy (SEM) is used to understand the microstructure of the films. Three electrode cells with 1 mol/L LiClO4/PC electrolyte are fabricated using the prepared WO_3 films as active working electrode and the electrochemical properties of the films as a function of coloration-bleaching cycle is characterized by cyclic voltammetry (CV). The main features of cyclic voltammograms (CVs) of thin electrochromic films are investigated. Major CV peaks can be simply understood as charging and discharging of the variable capacitor. The results reveal that the WO_3 film containing 4% w OAD shows a growth in grain size. A noticeable decline in the anodic peak current maximum can be contributed to its microstructure. The potential for fabrication nanostructured tungsten oxide films with superior charging and discharging capacity, for practical “smart window” applications is demonstrated.

Keywords: Nanostructure, WO_3, electrochromic, cyclic voltammetry, sol-gel

Synthesis and evaluation of a molecularly imprinted nano-polymer for solid phase extraction of ethopabate from chicken tissue sample method

Afshin Rajabi Khorrami*, Mahtab Edrisi

Department of Chemistry, Faculty of Science, Islamic Azad University, Karaj Branch, Karaj, Iran

* *Corresponding author: chemafshin@gmail.com*

Abstract

In this paper the development and evaluation of a molecularly imprinted nano-polymer (MINP) for ethopabate is described. Ethopabate (ETP), 4-acetamido-2-ethoxybenzoic acid methyl ester, is one of the antibiotics, which is used as coccidiostat in poultry feeds. In the present study, two widely used functional monomers methacrylic acid (MAA) and 4-vinylpyridine (4-VP) were compared theoretically and experimentally as the candidates for MINP preparation. Hyperchem software was employed to estimate binding energies between ETP and functional monomers and batch rebinding experiments were performed to study the binding characteristics of the polymers. The results showed that MAA is a better functional monomer to prepare MINP. UV/V is and NMR spectroscopy were used as two common tools to study the interactions between ETP and MAA in the pre-polymerization mixture. Liquid chromatography experiments showed that the prepared MINP has recognition capability toward ETP in comparison with other structurally related compounds. The ETP-imprinted polymer was further applied for selective solid phase extraction (SPE) of ETP from chicken tissue sample. The extraction yield of ETP was found to be quantitative (87±3%). In addition, the LOD and LOQ based on 3 and 10 times of the noise of HPLC profile were 0.05 and 0.32 ng ml^{-1}, respectively. It was confirmed that the binding ability of the prepared MINP for ETP was essentially sufficient in the presence of other compounds coexisting in tissue sample. Therefore, as a selective and efficient solid phase material, ETP-imprinted polymer has a high potential application in the analysis of residues of this antibiotic in chicken tissue samples.

Keywords: Ethopabate; Molecularly imprinted polymer; Solid phase extraction; Chicken tissue

Small polaron hopping conduction in Ni doped LaFeO3 nanomaterials

M. Wasi Khan[a,*], Shahid Husain[a], Maneesha Gupta[a], Ravi Kumar[b], J. P. Srivastava[c]

[a] *Department of Physics, Aligarh Muslim University, Aligarh-202 002*

[b] *Inter-University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110 067*

[c] *Department of Applied Physics, Aligarh Muslim University, Aligarh-202 002*

[*] *Corresponding author: wasi7@rediffmail.com*

Abstract

The electrical transport properties of LaFe1-xNixO3 ($0.1 \leq x \leq 0.6$) bulk samples were investigated over a wide temperature range, 9-300 K. The powder x-ray diffraction (XRD) patterns at room temperature show that all samples are formed in nano form and in single phase. However, a structural transformation is observed from orthorhombic (Pnma) to rhombohedral crystal symmetry at $x>0.5$ in Ni doped samples, which is supported by the electrical transport analysis. The temperature dependent resistivity data have been fitted with the Mott's variable-range hopping (VRH) model for a limited range of the temperature to calculate the hopping distance (Rh) and the density of states at Fermi level (N(EF)). It is found that all parameters vary systematically with the increase in Ni concentration. Moreover, the resistivity data were also fitted in the small polaron-hopping (SPH) model. The non-adiabatic small polaron hopping conduction mechanism is followed upto 50% Ni concentration while adiabatic hopping conduction mechanism is active above it. Such a change in the conduction mechanism is far accompanied by subtle electronically induced structural changes involving in Fe3+-O-Fe3+ and Fe3+-O-Ni3+ bond angles and bond length. Thus we suggest that the transport properties can be explained according to the additional delocalization of charge carriers induced by Ni doping.

Synthesis, Characterization, Fabrication

Effect of gas mixture on the growth of nitride nanoparticles and nitride layer properties in pulse plasma-nitrided AISI H11 steel

Hamze Forati Rad[a], Ahmad Ali Amadeh[a,*], Shahrokh Ahangarani[b], Hadi Moradi[c]

[a] *School of Metallurgy and Materials Engineering, Faculty of Engineering, University of Tehan, P.O.Box 11155-4563, Tehran, Iran*

[b] *Advanced Materials and Renewal Energies Dep., Iranian Research Organization for Science and Technology, Tehran, Iran*

[c] *Maham Industries, Tehran, Iran*

[*] *Corresponding author: amadeh@ut.ac.ir*

Abstract

In plasma nitriding process, it is very important to enhance the density of reactive nitrogen species. One of the methods used, is to mix a gas with an ionization potential lower than that of nitrogen. In this study, AISI H11 hot working tool steel has been pulse plasma nitrided in various nitrogen–hydrogen gas mixtures to study the effect of hydrogen content on the growth of nitride nanoparticles. The nanoparticles have been studied by scanning electron microscopy (SEM), X-ray diffraction (XRD) and microhardness measurements. The results showed that an increase in hydrogen percentage increased the size of nitride nanoparticles present on the surface but decreased their density and so, reduced the surface hardness.

Keywords: Hydrogen; Plasma nitriding; Hot working steel

Novel Pseudoaffinity Adsorbent for Purification of Nanobioparticle

Solmaz Hajizadeh[a], Mohsen Jahanshahi[a,*], Mohammad Hossein Sanati[b]

[a] Nanobiotechnology Research Laboratory, School of Chemical Engineering, Babol University of Technology, Babol, Iran. POBox 484

[b] The National Research Center for Genetic Engineering and Biotechnology, Tehran, Iran.

[*] Corresponding author: mjahan@nit.ac.ir

Abstract

The purification of mucin as a drug carrier by using boronate affinity chromatography (BAC) has been studied in the present work. BAC is a novel separation technique, which eliminates nonspecific boronate–protein interactions. Eupergit C was applied for the first as a support in chromatography column. Batch binding experiments and effect of different pH on the purification were considered strongly in this work.

Keywords: nanobioparticle, isotherm studies, phenylboronic acid, pseudoaffinity chromatography

Utilization of Super Para-magnetic Nano Particles in Discovering New Proteins Involved in Molecular Control of Cancer Cell Death

Adeeb M. Al-Zoubi[a,*], Abdallah K. Al Asal[b], Bellur Prabhakar[c], Mohammed El-Khateeb[d]

[a] *Department of Biotechnology and Genetic Engineering, College of Science, Philadelphia University, Amman Jordan*

[b] *Department of Applied biological science, College of Sciences and Arts, Jordan University of Science and Technology, Irbid, Jordan*

[c] *Department of Microbiology and Immunology, College of Medicine, the University of Illinois at Chicago, IL, USA*

[d] *College of Medicine, The University of Jordan, Amman, Jordan*

[*] *Corresponding author: aalzoubi@gmail.com*

Abstract

Alternative splicing of eukaryotic pre-mRNAs is a complex process that is highly regulated by an orchestrated assembly of a large protein complex called the spliseosome. Previously, we have shown that IG20 pre-mRNA undergoes alternative splicing, generating several mRNA transcripts with different protein functions. Two IG20 protein isoforms, IG20pa and DENN-SV, have been shown to play contrasting roles in cancer cell death. Our results indicated that IG20pa suppresses tumor cell survival and enhances their killing by several anti-cancer agents, including tumor necrosis factor-alpha (TNF-a), whereas DENN-SV increases resistance of cells to killing and increases rate of cell proliferation. In human tissues, DENN-SV demonstrated a constitutive expression in almost all body tissues tested, with much higher levels in tumors than in normal tissues, whereas expression of IG20 appeared to be regulated. How the expression of IG20 splice isoforms is regulated is not yet understood.

Our results in this study confirm previously published results regarding the coordinated tumorigenic properties of both DENN-SV and hnRNPK. Together, these results suggest a correlation between resistance of cells to TNF-alpha-induced apoptosis, up-regulation of DENN-SV expression, and up-regulation of hnRNPK expression. The mechanism by which hnRNPK affects alternative splicing of IG20 pre-mRNA, and whether cellular resistance to TNF-alpha-induced apoptosis is a cause or consequence of hnRNPK binding to IG20 pre-mRNA, is yet to be investigated. This work is of high significance, since it may lead to developing anti-cancer agents by targeting hnRNPK-IG20 mRNA interaction.

Effect of process parameters on the formation of nanoparticles in plasma nitriding of hot working steel

Hamze Forati Rad[a], Ahmad Ali Amadeh[a,*], Shahrokh Ahangarani[b], Hadi Moradi[c]

[a] *School of Metallurgy and Materials Engineering, Faculty of Engineering, University of Tehan, P.O.Box 11155-4563, Tehran, Iran*

[b] *Advanced Materials and Renewal Energies Dep., Iranian Research Organization for Science and Technology, Iran*

[c] *Maham Industries, Tehran, Iran*

[*] *Corresponding author: amadeh@ut.ac.ir*

Abstract

Plasma nitriding is one of the effective methods for improvement the hardness, wear and corrosion resistance of steels. In this research AISI H11 hot working tool steel has been plasma nitrided in various gas mixtures for different times and temperatures. The morphology, size and composition of nitride nanoparticles formed on the surface of the specimens have been investigated using scanning electron microscopy (SEM), X-ray diffraction (XRD) and microhardness measurements. The results showed that an increase in the time and/or temperature of nitriding process encouraged the agglomeration of nitride precipitates and reduced the content of ε phase which led to a decrease in surface hardness. Instead, increasing the amount of nitrogen in the gas composition, promoted the formation of ε phase which increased the surface hardness.

Keywords: Plasma nitriding, Nitride nanoparticles, Agglomeration

Fluid Flow in Curved Rectangular Microchannels

Ala'aldeen T. Al-Halhouli*, Stephanus Büttgenbach
Institute for Microtechnology (IMT), Technical University Braunschweig, Germany
** Corresponding author: a.al-halhouil@tu-bs.de*

Abstract

The rapid developments in biomedical and μTAS systems encourage continuous efforts on modeling the fluid flow characteristics in several microchannel protrusions (e.g. straight, circular, and spiral). The volumetric fluid flow in such configurations can be described by the Poiseuille flow model as in the ferrofluidic micropump [1], and by Couette-Poiseuille flow model in the single disk, double disk and spiral channel viscous micropumps (Fig.1) [2, 3]. Previous published results were directed toward investigating the influence of geometrical design parameters (e.g. channel height, width, curvature, and radius) on the volumetric fluid flow performance for a wide range of geometrical design parameters without considering the influence of shear stresses and friction factor under the same conditions[4, 5, 6]. These devices were proposed for pumping fluids carrying small particles that are sensitive to shear stresses (e.g., red blood cells that are suspended in plasma).

Business

Successes in Nanotechnology Commercialization

Faruq Marikar
President, Nanobiz, LLC, Scotch Plains, NJ
Corresponding author: fmarikar@nanobizllc.com

Abstract

Nanotechnology is a powerful new tool that has led to novel unprecedented products. There are also many examples of continual improvements of established technologies. Much more importantly, and in ways that are not widely recognized, nanotechnology has enabled the re-imagining of new products and technologies that were rejected as impractical or uneconomical only a decade ago. A prominent example of that is emerging is the new lithium batteries for the electric car. Will fuel cells be next?

Other aspects of nanotechnology that this talk will highlight are the global proliferation of innovation that has eased innovation monopolization, and the crucial need for alliances and partnerships to bring products to the market.

Nanobiz offers business, investment, patent and legal guidance on alternate energy, materials, cleantech and nanotechnology commercialization. Nanobiz helps large companies grow and small companies grow up (more at www.nanobizllc.com). Earlier, with Hoechst, Celanese, Gould, and SGL Carbon, Marikar planned and developed new businesses through global cross-sector alliances. Product areas include batteries, capacitors, fuel cells, films, paints, coatings, plating, corrosion, carbon fiber, graphite, specialty chemicals, plastics, electronic chemicals, ceramics, and composites.

Following his degrees in chemistry and a Ph.D. in engineering from the Indian Institute of Science, Bangalore. Taught corrosion, and worked at Imperial College, London and RPI in Troy, NY. He has 23 patents, 10 of them in the USA, in batteries, fuel cells, coatings and nanomaterials. He served on an industrial advisory committee to the US NSF; he was the first chairman of the US Industrial Research Institute's External Technology Directors' Network. He is currently on the Board of the ACS – Chemical Marketing & Economics Group. He was the founding chairman of the Materials & Components working group of the US Fuel Cell Council. He has written on competitiveness and organized a conference on University-Industry collaboration.

Iran Strategy for using nanotechnology in packaging industry

H. Afshari
Assistant professor of Azad University (Rodehen branch)

Abstract

Nanotechnology research has emerged as one of the most revolutionary scientific topics in decades. Nanotechnology focuses on the physical/biological structures smaller than 100nm which result in unique properties because of their nanosize. Some of these structures can be manipulated and converted into nanomachines able to achieve functions previously not possible.

Agriculture losses are one of the world challenges that is noticed from Iranian government. The objective of this paper is to illustrate the usage of nanotechnology in agriculture losses and to show what is the strategy of Iran for using nanotechnology in packaging industry in purpose of decreasing it.

Today, food packaging and monitoring are a major focus of food industry-related nanotech R&D. Packaging that incorporates nanomaterials can be “smart,” which means that it can respond to environmental conditions or repair itself or alert a consumer to contamination and/or the presence of pathogens. In this article market of nanopackaging and affects of that in losses are investigated in details.

Keywords: Nanotechnology, Packaging, Iran

Creating nanotechnology network between region countries, the best method for cooperation

Mohammad Ali Bahreini Zarj
Iran Nano Business Network, No. 15, Golha Blvd., Habibollah St., Sattarkhan St., Tehran, Iran
Corresponding author: alibahreini@gmail.com

Abstract

The region's countries have numerous potentials in various fields. Popular universities, committed human resources, different facilitations together with big investments in areas like gas and oil, petrochemicals, water, construction industry and etc on one hand proves the potential for entering nanotechnology field and on the other hand is an indicator of a great potential market for a wide range of nanotechnology products.

In case of a proper management of resources, based on satisfying the major requirements, is exerted, this region can become an influential hub in nanotechnology world. The creation of nanotechnology network among region's countries can help to discover many of these potentials and turn them into action. It can also lead to optimum allocation of financial and human resources to resolve the region's main challenges.

In this article, network's creation process, prerequisites and resources needed, upcoming challenges and its predictable future have been mentioned.

Keywords: Nanotechnology; Business Network; Cooperation

Nanotechnology helps solve the developing countries' problem, yes or no

Mohammad Ali Bahreini Zarj[a,*], Mahdieh Adib Zarchi[b]

[a] *Iran Nano Business Network, No. 15, Golha Blvd., Habibollah St., Sattarkhan St., Tehran, Iran*

[b] *Youths National Organization, No. 77, Saye St., Afrigha St., Tehran, Iran*

[*] *Corresponding author: alibahreini@gmail.com*

Abstract

The technology gap between developed and developing countries is a big challenge that humankind is facing. Nanotechnology is on the eve of entering human life. It has agape effect on quality of life. Can this technology help the developing countries in solving their problems? Can developing countries make use of this potential properly? What kind of challenges do they face in entering nanotechnology area? Can they cope with this trend? Yes or no?

Nanotechnology can potentially produce better quality of life and solve problems in areas and issues like environment, hygiene, health, water, poverty, air pollution and optimal utilization of natural resources.

The emergence of nanotechnology has been so fast that nations are unable to track it. New materials can totally transform the traditional materials' market. This trend replaces the resource of industrial and law materials and change the revenue of developing countries.

In this article, the status of nanotechnology (including articles, patents, and so on) in developing countries has been mentioned and solutions have been introduced to help them overcome their weaknesses.

Keywords: Nanotechnology; Developing countries; Quality of life

Case Study: Business Improvement through Nano-Network Design

Mohammad Ali Bahreini Zarj[a,*], Alireza Aghaee[b]

[a] *Iran Nano Business Network, No. 15, Golha Blvd., Habibollah St., Sattarkhan St., Tehran, Iran*

[b] *Iran Nano Business Network, No. 15, Golha Blvd., Habibollah St., Sattarkhan St., Tehran, Iran*

[*] *Corresponding author: alibahreini@gmail.com*

Abstract

One of the most challenging problems of the developing countries in the filed of nanotechnology, is the difficulty in creation and development of related businesses. Some of the main barriers in this way include:

Not having suitable infrastructure for financing companies (for example, there is no clear method for assessing the know-how or technology or human resource in a company's asset and there are limited resources for venture capital);

No proper potential market for new and innovative products;

Inability to get a global market share;

No public awareness of socio-cultural issues of technology.

In order to solve the above problems, Iranian companies have come together to create nanotechnology business network (NBN). The network's goals are to make the nano companies competent and create synergy between them. For example, creation a brand positioning for NBN is one of its duties.

Some of the NBN's resources include:

Governmental resources;

Big Enterprises' resources;

Charity donations.

Presently, NBN has more than 20 members, www.inbn.ir. Besides, 40 laboratories give the required services to the companies. The site of the laboratories is www.nanolab.ir. Universities and research centers are also the collaborators of the network. The reason for creation of the network, management experiments, members, challenges and future programs are explored in this article. This model can be offered to other countries.

Keywords: Nanotechnology; Business Network

Author Index