ABSTRACT BOOK

Hanoi International Symposium on Advanced Materials and Devices (HISAMD2019)

Hanoi, Vietnam, January10-12, 2019

Hosted by Hanoi University of Science, Vietnam National University

WELCOME MESSAGE FROM THE CHAIRS

The 2019 Hanoi International Symposium on Advanced Materials and Devices (HISAMD2019) is organized with the aim of promoting both fundamental and applied research activities in the field of Advanced Materials and Devices at the Hanoi University of Science – Vietnam National University (HUS-VNU) through its collaboration with national and international institutions.

The symposium will be held at the Hanoi University of Science, 334 Nguyen Trai, Thanh Xuan, Hanoi, Vietnam, from January 10 to 12, 2019. HISAMD2019 will consist of keynote and invited presentations from world-leading scientists, along with the poster session.

On the 20th Anniversary of the Center for Materials Science (CMS) at HUS–VNU, HISAMD2019 will feature the Center's notable research achievements over the last twenty years, as well as create a forum for young scientists to share and learn about the most recent developments in the field of advanced materials and devices.

The organizers of HISAMD2019 would like to invite you to attend and present your works at this symposium.

Symposium Chairs:

Prof. Bach Thanh Cong
Hanoi University of Science,
Vietnam National University, Vietnam

Prof. Manh-Huong Phan
University of South Florida, USA

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KEYNOTE TALKS

Keynote talk 1 (2019 IEEE Magnetics Distinguished Lecture)

Tuning magnetic anisotropy in nanostructures for biomedical and electromagnetic applications

Hari Srikanth

University of South Florida, USA

Magnetic nanoparticles have been building blocks in applications ranging from high density recording to spintronics and nanomedicine [1]. Magnetic anisotropies in nanoparticles arising from surfaces, shapes and interfaces in hybrid structures are important in determining the functional response in various applications. In this talk I will first introduce the basic aspects of anisotropy and discuss resonant RF transverse susceptibility, that we have used extensively, as a powerful method to probe the effective anisotropy in magnetic materials. Tuning anisotropy has a direct impact on the performance of functional magnetic nanoparticles in biomedical applications such as contrast enhancement in MRI and magnetic hyperthermia cancer therapy. I will focus on the role of tuning surface and interfacial anisotropy with a goal to enhance specific absorption rate (SAR) or heating efficiency. Strategies going beyond simple spherical structures such as exchange coupled core-shell nanoparticles, nanowire, nanotube geometries can be exploited to increase heating efficiency in magnetic hyperthermia [2,3]. In addition to biomedical applications, composites of anisotropic nanoparticles dispersed in polymers pave the way to a range of electrically and magnetically tunable materials for RF and microwave device applications [4]. This lecture will combine insights into fundamental physics of magnetic nanostructures along with recent research advances in their application in nanomedicine and electromagnetic devices.

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Biography

Hari Srikanth *is a Professor of Physics at the University of South Florida in Tampa, FL. He received his Ph.D. in experimental condensed matter physics from the Indian Institute of Science. After postdoctoral research for several years, Hari joined USF in 2000 and established the Functional Materials Laboratory. His research spans a wide range of topics including magnetic nanoparticles, magnetic refrigerant materials, spin calorics and complex oxides. He has around 250 journal publications and given numerous invited talks. Hari is a Fellow of the American Physical Society and a Senior Member of IEEE. He is also an Associate Editor for Journal of Applied Physics. Hari has been closely involved with the MMM and INTERMAG conferences for more than 15 years serving as Publication Editor, Publication Chair and on program committees.*

Keynote talk 2

Novel micro-magnetophoresis toward multiplex cell tweezers

CheolGi Kim

Department of Emerging Materials Science, DGIST, Daegu, 42988, Republic of Korea

The remotely controllable cells manipulation in a lab on a chip systems promises to play a key role towards multiplex cell tweezers for single cell analysis, cell separation and inter-cellar interaction. Particularly, most existing single cell platforms are unable to achieve large scale operation with flexibility on cells and digital manipulation, and thus there is urgent need of innovative techniques to accomplish the automation of single cells. Recently, the flexibility of magnetic shuttling technology using nano/micro scale magnets for the manipulation of particles has gained significant advances and has been used for a wide variety of single cells manipulation tasks.

Drawing inspiration from general circuit theory and magnetic bubble technology, here we demonstrate a class of integrated circuits for executing sequential and parallel, timed operations on an ensemble of collected cells [1,2,3]. The integrated circuits are constructed from lithographically defined, overlaid patterns of magnetic film and current lines. The magnetic patterns passively control particles similar to electrical conductors, diodes, and capacitors. The current lines actively switch particles between different tracks similar to gated electrical transistors. When combined into arrays and driven by a rotating 3D-magnetic field clock, these integrated circuits can implement general multiplexing properties and enable the precise control of arbitrary objects with magnetization contrast relative to its surroundings.

In this talk, I will present the magnetic domains of different micro-magnetic tracks, the governing magnetic force and energy of transporting superparamagnetic carriers, as well as a completed Spintrophoretic platform for multiplexed cell tweezers.

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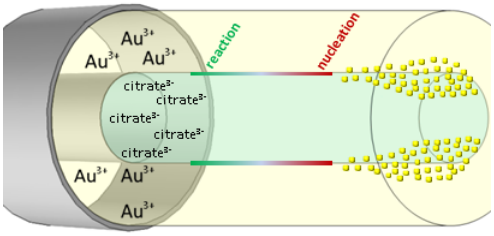
Keynote talk 3

Plasmonic and magnetic nanomaterials for biomedical applications

Nguyen T. K. Thanh

UCL Healthcare Biomagnetic and Nanomaterials Laboratory, 21 Albemarle Street, London W1S 4BS & Biophysics Group, Department of Physics & Astronomy University College London Gower Street, London WC1E 6BT, UK

In this presentation, I will present the most recent results from our group on synthesis and biofunctionalisation of plasmonic nanoparticles for potential biomedical applications in diagnosis and treatment of diseases.



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3. Pallares, R.M., Sutarlie, L., **Thanh, N.T.K**.* and Xiaodi Su (2018) Tunable plasmonic colourimetric assay with inverse sensitivity for extracellular DNA detection. ***Chemical Communications***, **54:** 11260 – 11263. **Front cover.**

4. Baber, R., Besenhard, M.O., LaGrow, A.P., Mazzei, L., **Thanh, N. T. K*** and Gavriilidis, A. (2018) Effects of Mass Transfer on Nanoparticle Syntheses: A Case Study for Silver and Gold. *CrystEngComm*. **20**: 7082-7093. **Inside Front Cover.**

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Keynote talk 4

New materials solutions for EUV lithography

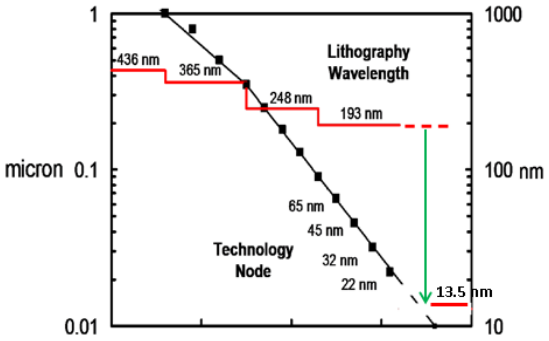
Jinho Ahn

Department of Materials Science and Engineering

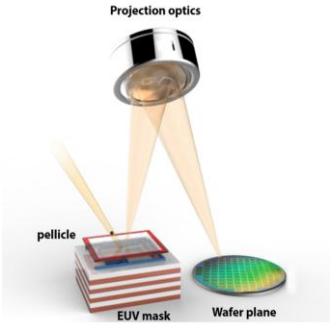
Hanyang University, South Korea

Extreme Ultra Violet lithography (EUVL) is the most advanced patterning technology which can be applied to the mass production of semiconductor devices. Due to the continuous efforts to solve the numerous technical issues, EUV lithography is going to be inserted into high volume manufacturing from this year. It took more than 32 years to get ready for industrial application since the first pioneering studies on EUV lithography. EUV scanner can now print 13nm feature size with 1.5nm overlay accuracy at 125WPH speed. The source power, which has been a bottleneck for a long time, showed 10 x improvements during the last five years and now 250W is achieved in factory.

Due to the highly absorbing characteristics of EUV wavelength, EUVL is operated by reflective optics rather than by refractive optics. Therefore, a reflective mask is required for the first time in lithography and the material selection for EUV mask is very important for lithography process performance. Also EUV pellicle - a mask protection solution for the printable fall-on adder defects – is a critical issue which can be solved by nano material technologies. During the presentation, our research activities on advanced masks and pellicles will be introduced together with reviews on general issues on EUV lithography technologies.



Wavelength reduction trend in lithography



Reflective mask and pellicle concept

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Keynote talk 5

Defect chemistry of functional oxides for energy storage/conversion applications

Kuan-Zong Fung, Shu-Yi Tsai, Chi-Yang Liu

Department of Materials Science and Engineering, National Cheng Kung University

Hierarchical Green-Energy Materials Research Ctr, National Cheng Kung University

Due to their unique electrical/electrochemical properties, functional oxides have become key components for advanced energy storage/conversion devices such as Li ion batteries and solid oxide fuel cells (SOFCs). Moreover, the desired electrical/electrochemical properties are obtained based on the consideration of specific defect reactions.

During a charging process of Li ion batteries, electrons are drawn from the cathode to the outer circuit along with the extraction of Li ions into the electrolyte. However, interesting behaviors are being observed in some new cathode materials. For examples, Li-rich layer-structured cathode formulated as xLi_2MnO_3-(1-x)$LiMO_2$(M = Mn, Ni, Co, etc.) was found to exhibit a unique charging plateau accompanying oxygen release/vacancy formationn during 1st charging process. In the following discharging, activation/reduction of Mn^{+4} giving a reversible capacity as high as 250 mAh/g was observed (Fig.1).

Interesting defect reaction was also observed in $Li_4Ti_5O_{12}$ (LTO) spinel anode. Under low pO_2, lattice oxygen near surface of LTO tends to be removed with the introduction of Ti^{+3}. As a result, the electron conduction and electrochemical properties of LTO was significantly improved.

Keynote talk 6

Spin-Orbital Coupling Effects in Electrically Polarizable Organic-Inorganic Semiconducting Perovskites

Bin Hu

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Organic-inorganic semiconducting perovskites have demonstrated very attractive room-temperature magneto-optical response, remarkable photovoltaic actions, color-tunable light-emitting properties, and low-threshold lasing actions, to become emerging multifunctional materials. On the other hand, organic-inorganic semiconducting perovskites possess a strong spin-orbital coupling within electrically polarizable semiconducting framework consisting of organic and inorganic components with ABX_3 structure. In general, spin-orbital coupling can generate three major outcomes: (i) Rashba effect, (ii) spin mixing between different states, and (iii) electric-magnetic coupling in such hybrid perovskites. It should be pointed out that organic-inorganic semiconducting perovskites show significant orbital momentum to form a strong spin-orbital coupling with spin momentum. Therefore, spin-orbital coupling provides an innovative mechanism to control optic, electronic, optoelectronic, and magneto-optic properties in organic-inorganic semiconducting perovskites. Based on spin-orbital coupling, magnetic field effects can be observed on excited states, leading to magneto-photoluminescence at room temperature. Furthermore, we found that changing spin-orbital coupling can shift the populations on different spin states, largely changing available states for generating light-emitting and photovoltaic actions. This presents a unique strategy to use spin-orbital coupling for controlling light-emitting and photovoltaic efficiencies in organic-inorganic semiconducting perovskites. Moreover, we found that the spin-orbital coupling can be optically operated by using circularly polarized photoexcitation. This provides the promising possibilities of tuning spin-polarized states, Rashba effect and electric-magnetic coupling by using optical photoexcitation. In summary, this presentation will discuss and review the recent studies on spin-orbital coupling effects in relationship with Rashba effect, spin mixing, and electric-magnetic coupling in organic-inorganic semiconducting perovskites.

Keynote talk 7

Charging of polar headgroups at the biomebrane interface

Doseok Kim

Sogang University, South Korea

Interactions between biomolecules such as protein, DNA, and membrane are essentially electrostatic, thus charge status and its change of these macro biomolecules at their surface under different environments are crucial for fundamental understanding of many biological processes. The change in the surface charge is usually borne out the by protonation/deprotonation of the chemical moieties such as headgroups of the lipids in the membrane or side chains of amino acids in the protein. In this talk I will introduce our recent findings on the protonation/deprotonation of the headgroups of the molecules consisting Langmuir monolayer (1) under the influence of salt, and (2) at different areas per molecules investigated by sum-frequency vibrational spectroscopy.

Keynote talk 8

Physics at low dimensions: Theoretical understanding

Hung-The Diep

Université de Cergy-Pontoise, Cergy-Pontoise, France

Low-dimensional systems attract an increasing interest over the years. On the one hand, technological progress has made it possible to fabricate and characterize systems of nanometric scale which lead to interesting industrial applications. On the other hand, theories and simulations of systems in 1D, 2D and films have allowed a good understanding of experimental data and permitted to foresee further applications.

I will show a number of systems in 2D and films where surface effects dominate thermodynamic properties. These results can be experimentally checked in various domains such as frustrated spin systems, surface magnetism, spin transport, phase transition and elementary excitations.

Simple systems in 2D can be exactly solved [1]. Results show that when frustration is introduced, many 2D systems possess spectacular exact properties such as partial disorder at equilibrium, reentrance, disorder line on which the system behaves as in one dimension (dimension reduction), multiple separate phase transions with increasing temperature, … These phenomena are believed to persist in films and in 3D. Some evidences are shown.

In films, it has been shown that surface spin-waves give rise to surface magnetization different from the bulk one. This can lead to surface phase transition at temperature quite different from the bulk [2]. I will show when frustration is combined with surface effects, interesting phenomena occur. Several examples of helimagnetic films and skyrmions [3] are shown.

Spin transport in films, a subject of intensive investigations due to applications in spintronics [4], will be shown and compared to experiments.

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Keynote talk 9

Spin-orbit torque switching in heavy metal-ferromagnet junctions for magnetic memory devices

Young Keun Kim

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Korea University, Seoul 02841, Korea

Switching magnetization direction of a ferromagnetic layer with high speed as well as low energy consumption has drawn emerging technological interest, for example, in the area of next-generation magnetic random access memory (MRAM) applications. Lately, a new switching principle so called spin-orbit torque (SOT) switching has been discovered in various sets of junctions consisting of nonmagnet (NM)/ferromagnet (FM)/oxide/capping layers such as (Ta,W)/CoFeB/MgO. In these junctions, an in-plane current injection induces magnetization reversal in perpendicularly magnetized layers. This switching is resulted from the spin-orbit interaction of either spin Hall effect or Rashba origin or mixed of the two. Therefore, many research efforts are being pursued worldwide to understand underlying physics, to search new sets of NM/FM material systems and device structures, and to manipulate interfacial structures to get high SOT efficiencies beneficial for reducing critical current densities for switching. To be practical for MRAM applications, there are various engineering issues to be resolved which are related with materials selection and processing. The current status and future aspects of SOT-related materials and device research are discussed.

Keynote talk 10

2D nanostructures and alloys for supercapacitor application

Jyh-Ming Ting

National ChengKung University, Taiwan

We report a number of hydrothermally-synthesized nanostructured materials for use as electrodes in supercapacitors. They include MoS_2 and its composites, Ni_3S_2, and $MnCo_2O_4$. 2D MoS_2 and its composites were fabricated through a microwaved assisted-hydrothermal (MAH). The resulting MoS_2 contains controllable 1T/ 2H ratios. Vertically aligned MoS_2 nanowalls were fabricated through direct growth of MoS_2 on carbon materials also using a MAH method. 1D $MnCo_2O_4$ and Ni_3S_2 were grown on nickel foam and carbon foam, respectively via conventional hydrothermal processes. The obtained nanostructures were investigated for use as electrodes in supercapacitors. Excellent SC performance is demonstrated.

Keynote talk 11

Faculty of physics -HUS material science research for technology, life science and environmental science, combining theory, simulation and experiment

Nguyen The Toan

VNU Hanoi University of Science, Hanoi, Vietnam

In this talk, I will present the organization of the Faculty of Physics along scientific research directions related to material sciences. Combining expertises from different groups, laboratories in theoretical, computational and experimental researches, we address up-to-date problems arising from many areas of technology, life science and environmental science. Our approach is multi-level and multi-disciplinary. Not only we coordinate researchers from different departments, we also collaborate with researchers from other faculties of HUS such as biology, chemistry etc., as well as from other Universities and Institutes inside and outside Vietnam. We have successfully carried out research grants at national level such as Nafosted, FIRST, International Bilateral Collaboration … to investigate and develop material science techniques such as nano-shell particles, thermo-magnetic materials and multi-layered materials in design and fabrication of bio-sensor, bio-chip, drug delivery, waste and toxic processing.

Keynote talk 12

Discovery of pressure induced new superconductor using materials informatics

Yoshihiko Takano

National Institute for Materials Science

Tsukuba University, Japan

Data-driven material science (materials informatics, materials genome initiative, chemometrics, and so on) recently brings remarkable results in the field of medicine and et al. On the other hand, a search for new functional materials of thermoelectric and/or superconducting materials has been still conducted through a carpet-bombing type experiment depending on the experience and inspiration of researchers.

We have exhaustively searched the candidates of new thermoelectric and superconducting materials by first-principles calculation as a guideline, which is a specific band structure of “flat band” near fermi energy, such as multivalley, pudding, and topological-type structures. If such kinds of flat band approach to the fermi energy, the thermoelectric properties of electrical conductivity and Seebeck coefficient would be enhanced. If the flat band crosses the fermi energy, superconductivity would appear due to high density of state (DOS) near the fermi energy.

In my presentation, I will talk about successful demonstration of the discovery of new superconductor under high pressure by data-driven materials research [1-2].

References:

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Keynote talk 13

Optical spectroscopy of layered 2-dimensional materials

Hyeonsik Cheong

Sogang University, South Korea

After graphene was first isolated in 2004, two-dimensional nanomaterials that include graphene, black phosphorus, and transitional metal dichalcogenides have become the focus of intense interest. The superb electrical, mechanical, or chemical properties of these materials make them excellent candidates for future applications in many areas such as flexible electronics. Furthermore, these atomically thin materials have become ideal platform to study physical phenomena in 2 dimensions. Some of new discoveries include quasi-crystallinity and superconductivity in twisted bilayer graphene and ferromagnetic and antiferromagnetic van der Waals materials. Optical spectroscopy has been one of the most important tools to study these materials. Raman spectroscopy, in particular, has been extensively utilized for characterizations such as determination of the thickness, charge carrier densities, defects, and mechanical deformations. In this presentation, I will review the recent progress in 2-dimensional materials research with the emphasis on the role of optical spectroscopy.

Keynote talk 14

Progresses in metamaterials as perfect absorbers for electromagnetic radiation

Vu Dinh Lam[1,2,*], *Bui Son Tung*[1,2] *and Bui Xuan Khuyen*[1,2]

[1]*Institute of Materials Science, Vietnam Academy of Science and Technology, Hanoi, Vietnam*
[2]*Graduate University of Sciences and Technology, Vietnam Academy of Science and Technology, Hanoi, Vietnam*

In recent years, the exotic ability to perfectly absorb the light of the artificial structures, the so-called metamaterial perfect absorbers (MPAs), contributes to the realization of future purposes, such as bolometers, thermal images, solar cells, sensors, photodetectors, etc. By the association of perfectly-matched impedance and strong resonance phenomenon the incoming electromagnetic (EM) wave is completely consumed inside a size far smaller than that of the traditional absorbers. For the rapid growth of telecommunication devices, in particular, we are investigating the ultrathin MPA models in the VHF and UHF bands (0.1 – 3.0 GHz) [1,2]. These works explain how we effectively reduce the size of MPA by increasing the effective inductance and the effective capacitance of traditional meta-patterns. Simultaneously, by integrating parasitic capacitors and through interconnects, the next generation of ultrathin and angularly-stable MPAs, which have an extremely-thin thickness (816 times smaller than the operating wavelength, for example), are realized in calculation, simulation and experiment. All proposed MPAs satisfies the practical requirements, which strictly demand a quite wide range of incident angle (from 30^o to 55^o) and polarization-independent behavior.

In addition to the miniaturization of MPA, the extension of absorption bandwidth is being studied by using different approaches. The first one is based on the near-field coupling of resonators and the second one is obtained by doping low-conductivity materials to MPA structure [3,4]. These results are promising for potential actualizations in the radio band, such as radio-frequency shielding devices, single/dual-frequency filters, and single/multi-mode switching devices.

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[4] B. S. Tung, B. X. Khuyen, Y. J. Kim, V. D. Lam, K. W. Kim, and YoungPak Lee, "Polarization-independent, wide-incident-angle and dual-band perfect absorption, based on near-field coupling in a symmetric metamaterial," Sci. Rep. 7, 11507 (2017).

INVITED TALKS

Invited talk 1

Toward accurate sub-100 nm mechanical measurements for soft and bio materials

Bernard Haochih Li

National Cheng Kung University, Taiwan

Nanoindentation reveals the mechanical properties, such as elastic modulus and hardness of the materials and has been widely applied on hard specimens including metals and ceramics. Despite the calibrations for both the instrument and the indenter before nanoindentation tests have been well described, the conventional protocol used to calculate sample modulus is still not suitable for soft matters such as polymers and biological microorganisms. Because of the dissimilar deformational mechanisms of the soft materials compared to that of the hard ones, the incorrect choice of contact models can lead to significant errors that obscure the mechanical characteristics of the specimen. Currently, this issue has not been attended and is still unresolved. To improve the accuracy and precision of the nanoindentation techniques on the polymers and biological samples, we investigated the effects of the experimental parameters on the measured modulus. The deformational behaviors of the soft matters were investigated to assist the establishment of a correct contact theory. The mechanical performances of the specimens obtained from nanoindentation were used for the modification of the contact mechanism models. As a result, we proposed a new model for nanoindentation based on the probe-sample interaction behavior. With the enhancement of the nano-bio-mechanical measurements, we aim to develop a surface probe method for the rapid recognition of clinical, biological cells, including cancer and normal cells, and different species of microorganisms.

Invited talk 2

Nanomaterials for biomedical and energy applications

Nguyen Hoang Nam

VNU Hanoi University of Science, Hanoi, Vietnam

Nanomaterials have attracted scientists due to their applications and potential applications, especially in biomedicine and energy, based on their nanosize. This report highlights the researches in selected groups of Faculty of Physics and Nano and Energy Center, VNU University of Science focusing on the synthesis, functionalization, and applications of metallic, semiconductor, magnetic nanoparticles and multifunctional nanoparticles, as well as thin films. These nanomaterials can be used for medical applications, such as early detection of breast cancer cells, basal cell carcinoma, Herpes DNA separation, $CD4^+$ cell separation and detection of pathogenic viruses as well as biological treatment targeting. They also can be candidate materials for applications in energy storage and energy converse. Finally, some promising perspectives will be discussed.

Invited talk 3

Colloidal semiconductor nanomaterials: from laboratory to consumer electronics

Cuong Dang

Luminous! Centre of Excellence for Semiconductor Lighting and Displays, School of Electrical and Electronic Engineering, Nanyang Technological University, The Photonics Institute (TPI), 50 Nanyang Drive, Singapore 639798

Given the advantages of wide bandgap tune-ability, stability of inorganic compounds and low-cost, flexible manufacture, disruptive CdSe-based colloidal quantum dot (QD) technology has found a way from the lab curiosities to the consumer electronic products in shopping centres. In this talk, we will discuss the current state of the art and the future of QD light emitting devices covering all the intensity levels. At the single particle levels, QDs are artificial atoms and emitting single photons on demand, such long-sought quantum sources are important for quantum technologies and quantum securities. Ensemble nanocrystal films can be processed as active layers following the flexible organic LED architectures to be quantum dot LEDs (QLED) with pure colour quality. Finally, the most advanced light emitting devices (i.e. lasers) are now can be enabled by the most cost-effective technology (i.e. colloidal process) with potentials to achieve “long sought” full-colour single-material lasers.

Invited talk 4

Experimentally characterizing electronic structures of oriented/textured soft semiconductors: The last step from theoretic design to real world

Bang-Yu Hsu

Department of Materials Science and Engineering

National Cheng Kung University, Taiwan

Soft semiconductors like semiconducting polymers, oligomers, and small molecules are capable of freely combining electronically active monomers to achieve desired functionalities. The combinations of these molecular units are almost infinite and imply versatile applications. Organic light emitting diodes, transistors, light emitting transistors, solar cells, photodetectors, and lasers have been made. However, the soft nature and complex intermolecular interactions of soft materials result in polymorphic state. Experimentally characterizing intrinsic electronic structures of soft semiconductors becomes a challenging task. Hence, simulation through density function theory was the most convenient way to predict and explain intrinsic electronic properties of soft semiconductors. However, seeing is believing. Once we can actually examine the predicted properties, the gap between theory and applications can be bridged. Then organic electronics can be as effective as the blossomed silicon industry. To achieve materials consistency, we must first remove extrinsic disorder from molecular conformation, i.e. align/crystallize these soft materials. Then electronic examinations will represent materials intrinsic and anisotropic nature. Otherwise, we can only obtain "averaged" isotropic properties from disordered and localized electronic state. In this talk, I will introduce the control over intermolecular interactions in nanoscale and the resultant highly-ordered semiconducting polymers. As the result of high order, the classic electronic/structural characterizations via synchrotron light sources can be applied to elucidate the profound insights of soft materials.

Invited talk 5

Giant magnetocaloric effect in magnetic materials

Seong-Cho Yu

Chungbuk National University, South Korea

Refrigeration magnetic (MR) based on the magnetocaloric effect in magnetic materials has shown many advantages and has potential to replace traditional refrigeration methods such as gas compression technology. In order to increase the efficiency of magnetic refrigerators as well as to apply these devices for different working temperature ranges, the researches have been expanded on many types of materials, including perovskites, alloys, ceramics, and amorphous materials.

In this presentation, we summarize the outstanding results of our group on the magnetocaloric effects of lanthanium and/or alkali manganite perovskites, Heusler alloys Ni-Mn-Sn, the Fe-Ni-Zr, Fe-Sn-Zr and $LaFe_{10-x}B_xSi_3$ -based amorphous ribbons, the polycrystalline ceramics of $Zn_{1-x}TM_xO$ (TM=Co, Cu, Fe, Cr, Mn) and Gd –based nano/micro-wires. Besides, discussions on the magnetic orderings and magnetic phase transitions in relation to the magnetocaloric properties will be given.

Invited talk 6

Structure and magnetic properties of Mn-substituted $(Fe_{1-x}Mn_x)_{75}P_{15}C_{10}$ magnetic ribbons

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Amorphous ribbons with composition $(Fe_{1-x}Mn_x)_{75}P_{15}C_{10}$ (with x = 0, 0.05, 0.1, 0.2 & 0.3) have been prepared by conventional melt spinning technique. XRD analysis of the ribbon-shaped samples has confirmed the amorphous nature of the samples. For further investigation the amorphous $(Fe_{1-x}Mn_x)_{75}P_{15}C_{10}$ ribbons were ball milled for 12 hours at a speed of 200 rpm. It is observed that high speed ball milling of the ribbons have transformed the samples into nanopowder with an average crystallite size of 30nm-50nm which has undergone a structural phase transformation into hexagonal structure. The M-H loop show that the remanence and the saturation magnetization are weakly influenced, while the coercivity increased dramatically from 0.02T to 0.11T at room temperature. However, at low temperature both the magnetization and coercivity have increased significantly. The frequency dependent complex permeability shows that the relative permeability drops dramatically from 22000 to around 20 and also has reduced the magnetic core loss. The temperature dependent permeability shows that the permeability increases at both low and at high temperatures which may be attributed to the substitution effect of Fe by Mn.

Invited talk 7

Applications of electron backscatter diffraction (EBSD) in materials science

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Electron Back-Scatter Diffraction (EBSD) has become a powerful tool for the characterization of crystalline materials. The applications of EBSD have significantly increased in the last ten years. Captured patterns can then be used to determine grain morphology and crystallographic orientation for the characterization of microstructure and the correlation between properties and performance of materials. Here we present characterization of deformation and recrystallization microstructure. In addition, some recent developments in EBSD are presented here for example, determination of stress and dislocation density, EBSD-ECCI technique for revealing dislocation structure.

Invited talk 8

Biomaterial-based Whispering-Gallery-Mode Micro-lasers

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Microlasers based on biomaterial have recently attracted enormous interest due to its promising potentials for future applications in medical treatments, biotracking, biosensing, etc. In this report, we demonstrate a simple, environmentally friendly fabrication of micro-lasers which were derived from starch, bovine serum albumin and ovalbumin doped with Rhodamine B in low weight ratio. Basing on the whispering gallery mode, the solid – state laser spheres with diameter ranging from 20 µm to 100 µm exhibit a lazing threshold of 2 µJ/pulse and Q factor of 3200. Due to the biology base, the microlasers are highly biocompatible, which demonstrate a potential prospect in both medical and biological applications.

POSTER PRESENTATION

P1-FPM

The influence of ball milling on crystal structure and magnetic properties of $(Fe_{1-x}Mn_x)_{75}P_{15}C_{10}$ alloy ribbons

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The amorphous ribbons with nominal composition (Fe1-xMnx)75P15C10 (with x=0, 0.05, 0.1, 0.2 & 0.3) were prepared by melt spinning technique. The structure of these type of samples is fully amorphous which is confirmed by XRD patterns. Then the amorphous (Fe1-xMnx)75P15C10 ribbons were milled up to 6 hours using an MSK-SFM-1 Bench Top planetary ball mill with a speed of 200 rpm. After ball milling, these type of ribbons transformed into nanopowders with the crystallite size of (30nm-50nm) which undergo crystallization into Hexagonal type. The M-H loop of this type of nanopowders (with shaping as the 5mg uniform cylinder using the pressure of 5000psi) has been tested at room temperature and temperature of 77 K through home-built VSM. Magnetic hysteresis loops show that the remanence and maximum magnetization values at are weakly influenced, while the coercivity increased dramatically from 0.02T to 0.11T at room temperature but at low temperature both magnetization and coercivity increases. Also, frequency and temperature dependent complex permeability of this type of nanopowders (with shaping as toroid using the pressure of 5000psi) have been tested through Wayne Kerr 6500B impedance analyzer. The frequency dependent complex permeability curve shows that the value of relative permeability drops dramatically from 22000 to around 20 and also reduces magnetic core lose and temperature dependent permeability curve shows that permeability increases both low and high temperature. The analysis of the structure shows a phase transformation of amorphous ribbons to crystalline nanopowder which led to a hard-phase magnetic property.

P2-FPM

Influence of pH on the structure, morphology and properties of Fe_3O_4/Ag hybrid nanoparticles

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The paper describes a kind of multifunctional Fe_3O_4/Ag hybrid nanoparticles, which can be successfully synthesized using a simple method based on linking and spontaneous reduction of silver ions with amin group modified magnetic nanoparticles (Fe_3O_4-NH_2). The silver ions were linked with Fe_3O_4-NH_2 nanoparticles in solution, which has pH = 5 – 11 to form different Fe_3O_4/Ag nanohybrid samples. The as-prepared samples have been characterized by x-ray powder diffraction (XRD), transmission electron microscopy (TEM), high resolution transmission electron microscopy (HRTEM), Fourier transform infrared (FTIR) spectrum, x-ray photoelectron spectroscopy (XPS), energy dispersive x-ray spectroscopy (EDS), vibrating sample magnetometer (VSM) and ultraviolet visible spectrum (UV-vis). These results show that the Fe_3O_4/Ag hybrid nanoparticles at pH 11 have the most sustainable structure, properties. The hybrid nanoparticles are promising to detecting and labelling cancer cells.

P3-FPM

Eco-friendly synthesis silver nanoparticles using lemon extract and rice vinegar

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School of Engineering Physics, Hanoi University of Science and Technology

Silver nanoparticles were synthesized at room temperature via Tollens process modified with stepwise method using eco-friendly precursors (lemon extract and commercial rice vinegar). We used both surfactant (lemon extract) and buffer solution of weak acids (formic acid and commercial rice vinegar) to control the size of silver nanoparticles. The reducing time and annealing process were investigated to optimize the preparation process. The mean size of silver nanoparticles and quantitative component of reaction products were theoretically determined using UV-Vis and X-ray Diffraction spectra. We also used Scanning Electron Microscopy to investigate the morphology and size of silver nanoparticles.

P4-FPM

Pressure induced modifications of the magnetic order in the spin chain compound $Ca_3Co_2O_6$

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The structural and magnetic properties of $Ca_3Co_2O_6$ spin chain compound have been studied by means of neutron and X-ray powder diffraction at pressures up to 6.8 and 32 GPa, respectively. A suppression of the initial spin density wave state (T_N = 25 K) and stabilization of the collinear commensurate antiferromagnetic (AFM) state at high pressures (T_{NC}= 26 K at P= 2.1 GPa) was observed. The pressure behaviour of the competing intra- and interchain magnetic interactions was analysed on the basis of obtained structural data and their role in the formation of the magnetic phase diagram is discussed. The pressure behaviour of the Neel temperature of the commensurate AFM phase was evaluated within the mean field theory approach and the good agreement with the experimental value dT_{NC}/dP = 0.65 K/GPa was obtained.

P5-FPM

Study of structure, optical, ferroelectric and ferromagnetic properties of Gd-doped $BiFeO_3$ materials

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$Bi_{1-x}Gd_xFeO_3$ (x = 0.00 - 0.15) materials were synthesised by a sol-gel method. The effect of Gd doping on the structural, ferroelectric and ferromagnetic properties of $BiFeO_3$ was investigated by X-ray diffraction (XRD), Raman scattering, energy-dispersive X-ray (EDX), polarization electric hysteresis loops and magnetization hysteresis loops measurements. The results showed that all samples present the perovskite-type rhombohedral structure. The a parameter decreases from 5.583 to 5.511 Å and c parameter decreases from 13.869 to 13.741 Å, optical band gap (E_g) decreases from 2.02 to 1.60 eV when concentration of Gd increases from 0.00 to 0.15. Ferromagnetism and ferroelectricty of Gd-doped $BiFeO_3$ materials enhanced than that of $BiFeO_3$ materials, the saturation magnetization (Ms) and saturation polarization (2Ps) increase up to 0.386 emu/g and 6.887 $\mu C/cm^2$, respectively. Origin of ferromagnetic and ferroelectric properties of $Bi_{1-x}Gd_xFeO_3$ materials will be discussed in this paper.

P6-FPM

Comparative study of Na and K doping on local structure and critical temperature of (Bi, Pb)-2223 superconductor

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Doping process on high temperature superconducting system has been widely studied to achieve the high T_c. In this paper, we studied the effect of doping process on the local structural characteristics and the superconducting properties of (Bi, Pb)-2223 superconductor. Superconducting materials with general compound of $Bi_{1.6}Pb_{0.4}Sr_2Ca_2Cu_3O_{10+\delta}$ samples are prepared by a solid-state reaction method, and Na and K substitution were conducted in the sites of Ca and Sr, respectively. The superconducting property of materials was characterized via standard four-probe method. The resistivity measurements showed the increase in T_c for Na-substituted samples, while T_c's of K-substituted samples were decreased. The local structure was characterized via X-ray absorption spectroscopy (XAFS) and the Cu K-edge X-ray absorption spectra was carefully analyzed to examine the Cu-O bonds. The Cu-O bond distance decreased in the Na-substituted samples with higher ordering of Cu-O bonds implying that the substitution of Na on the Ca site decreases the static disorder of Cu-O bond and maximizes the bonding stiffness in the (Bi, Pb)-2223 system, while the K-substituted samples revealed an opposite trend. These results indicate that local structural variation is closely correlated with T_c. The effect of disorder at various sites outside the Cu-O layer on T_c of (Bi, Pb)-2223 superconductor is discussed in more detail.

P7-FPM

Influence of Co and Al on magnetic properties and magnetocaloric effect of (Ni,Co)-Mn-(Sn,Al) alloys

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The paper shows the results of investigating the influence of Co and Al on magnetic properties and magnetocaloric effect of **(**Ni,Co)-Mn-(Sn,Al) alloy ribbons prepared by using melt-spinning method. X-ray diffraction patterns manifest multi-crystalline phase behavior of the ribbons including face centered cubic ($L1_0$), body centered cubic (B2), orthorhombic (4O) and monoclinic (10M). Amplitude and temperature of Martensite-Austenite phase transition of the alloy clearly depend on Co and Al concentrations. Magnetization measurements exhibit soft magnetic feature with coercive force less than 50 Oe for all the alloy ribbons. Curie temperature of the alloy increases with increasing the Co concentration and decreases with increasing the Al concentration. Magnetic phase transitions in the alloy can be shifted to room temperature region by adjusting Co and Al concentrations. With appropriate concentrations of Co and Al, the alloy ribbons possess both the positive and negative magnetocaloric effects with their maximum magnetic entropy change larger than 0.7 $J.kg^{-1}.K^{-1}$ in magnetic field change of 12 kOe. The temperature and magnetic field dependence of magnetocaloric effect in these alloy ribbons were also investigated.

P8-FPM

Magnetic and electrical properties of $(La_{0.7}Sr_{0.3}Mn_{0.98}Co_{0.02}O_3)_{1-x}(La_2NiO_4)_{0.9}(BaTiO3)_{0.1}]_x$ (x = 0.0; 0.1; 0.2; 0.3; 0.4) composites

Le Thi Anh Thu[*1], *Nguyen Ngoc Dinh*[1], *Bach Thanh Cong*[1] *and Tran Dang Thanh*[2]

Magnetic and electrical properties of composite $(La_{0.7}Sr_{0.3}Mn_{0.98}Co_{0.02}O_3)_{1-x}[La_2NiO_4)_{0.9}(BaTiO3)_{0.1}]_x$ (x = 0, 0.1, 0.2, 0.3 and 0.4) samples produced by combining solid-state reaction and high-energy mechanical milling methods have been investigated. Experimental results show that the conductivity of the x=0.1 composite sample has highest value in the temperature region above 200 K comparing with the others. The magnetic –paramagnetic phase transition temperature is nearly unchanged and the existence of two magnetic phases is observed in the samples with x=0.2 - 0.4. Relation between the magnetic and electronic properties is discussed in details. At the room temperature, the conductivity of our x=0.1 composite sample is about 20 time larger than that of the best conducting compound $(La_{0.7}Sr_{0.3}MnO_3)_{0.94}(BaTiO_3)_{0.06}$ studied in [1].

Reference:

[1] T. D. Thanh, P. T. Phong, D. H. Manh, N. V. Khiem, L.V. Hong, T. L. Phan, S. C. Yu, J. Mater. Sci.: Mater. Electron. 2018.

P9-FPM

Temperature dependent magnetic properties and domain observation of CoFeB/Pd multilayers

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Perpendicular magnetic anisotropy (PMA) thin films play a crucial role in emerging spin-electronic technology using the spin-transfer torque phenomenon [1]. Several advantages allow considering PMA amorphous CoFeB films as an excellent candidate for spin-transfer torque applications [2,3]. While most of the reported works have been focused on tuning the magnetic properties of CoFeB films at ultrathin level from application point of view, there are only a few reports available on the composition, thickness and temperature dependent magnetic properties of CoFeB films from the fundamental point of view.[4] We report a systematic study of temperature dependent and the detailed magnetization process in terms of in-situ observation of magnetic domain structure in the series of amorphous (4-Å CoFeB/10-Å Pd)$_n$ (n = 2, 4, 6, 8, and 10) multilayer films with changing the number of n, the magnetic properties of CoFeB thin films in the temperature range between 220 and 450 K. The observed results are discussed on the basis of development of temperature and thickness dependent effective magnetic anisotropy, which changes the magnetic domain structure with increasing CoFeB film thickness.

Reference:

[1] Duc-The Ngo, Duy-Truong Quach, Quang-Hung Tran, Kristian Møhave, The-Long Phan and Dong-Hyun Kim, J. Phys. D: Appl. Phys. 47, 44 (2014).

[2] J. H. Jung, B. Jeong, S. H. Lim, and S.-R. Lee, Appl. Phys. Express 3, 023001 (2010).

P10-FPM

Hydrothermal synthesis and optical properties of in-situ Gr@WO_3-nanorod hybrid material

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In this work, graphene (Gr) was in-situ hybridized with tungsten oxide nanorod (WO_3-NR) by hydrothermal method. The X-Ray diffraction results indicated that the in-situ Gr@WO_3-NR hybrid materials were successfully synthesized with the Graphene weight percents of 0.1, 0.3, and 0.5 in comparison with precursor $Na_2WO_4.2H_2O$. When weight percent of Gr is higher than 1%, Gr inhibits the formation of the nanorod. The hybrid materials had optical band-gaps in the visible region which show applicability in photocatalyst. The binding and formation of hybrid materials were characterized by X-Ray diffraction analysis and Raman spectroscopy. We used field emission scanning electron microscopy to investigate the morphology of materials. Optical properties of materials were characterized by Reflectance spectroscopy.

P11-FPM

Influence of Cr-concentration on magnetic properties and magnetocaloric effect of Fe-Cr-Gd-Zr-B rapidly quenched alloys.

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In this paper, influence of Cr on structure, magnetic properties and magnetocaloric effect of $Fe_{82-x}Cr_{4+x}B_2Gd_2Zr_{10}$ (x = 1, 2, 3 and 4) alloy ribbons were investigated. The ribbons with thickness of ~ 25 mm were prepared by using melt-spinning method on a single roller system. X-ray diffraction analysis shows that the ribbons are almost amorphous. By changing the concentration of Cr in a range of 5-8 at%, the Curie temperature of the alloy is regulated at room temperature regions. Temperature dependence of magnetic entropy change, $\Delta S_m(T)$, was calculated basing on M(H) data determined at various temperatures. With magnetic field change of 12 kOe, the maximum magnetic entropy change, $|\Delta S_m|_{max}$, of the alloy is larger than 0.8 $J.kg^{-1}K^{-1}$. The wide working temperature range, ΔT_{FWHM} > 90 K, around room temperature have been achieved on these alloy ribbons, showing high possibility of the alloy for practical application in magnetic refrigerators.

P12-FPM

Structural and magnetic properties of chromium-substituted nickel ferrite synthesized by Sol-Gel method

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The structural and magnetic properties of $NiFe_{2-x}Cr_xO_4$ (x = 0, 0.3, 0.5, 0.7, 0.9, 1.1, 1.3, 1.5) nanoparticles prepared by Sol-gel method were investigated. The cubic spinel structure of Cr-substituted ferrite nanoparticles was confirmed by x-ray diffraction. The lattice constant slightly decreases with increases in Cr^{3+} content. The mean crystallite size of the samples determined by using the Scherrer's equation is found in the range of 12-20 nm. The morphology and size distribution of the particles were observed by transmission electron microscopy (TEM). The saturation magnetization M_S and coercive force H_C decreases with chromium substitution. The chromium concentration in $NiFe_{2-x}Cr_xO_4$ nanoparticles leads to magnetic inhomogeneity supported by phase transition points on the M-T curve which was explained based on the magnetic moment disorder, cation distribution of Cr^{3+} and finite-size effects in nickel ferrite.

P13-FPM

Cu_2O nanoparticles: A simple synthesis, characterization and its photocatalytic performance toward Methylene Blue

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Cuprous oxide nanoparticles (Cu_2O) were prepared by a one-step reduction method in low temperature. The Cu_2O were characterized by XRD, Raman, SEM and UV-Vis techniques, respectively. The adsorption removal of methylen blue from aqueous solution by the as-prepared Cu_2O was studied. Kinetics and isotherms studies suggested that the adsorption process followed pseudo-second-order and Freundlich models. The adsorption was a physical process. The photocatalytic activity of Cu_2O was evaluated by the removal of methylen blue aqueous solution under visible light irradiation. The results show the excellent photocatalytic activity and the corresponding removal rate of MB achieved more than 98%.

P14-FPM

Density functional studies of the adsorption of CO on TiO_2 anatase surfaces

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The adsorption of CO on TiO_2 anatase (001) and (101) surfaces were calculated using $Dmol^3$ package in the framework of the density functional theory (DFT). In particular, the optimized structural calculations of CO adsorbed on the modified (1x4)-(001) and unmodified (2x3)-(101) TiO_2 anatase surfaces show that CO prefers to be adsorbed perpendicular to the surface with C atom oriented toward to the surface. All of the stable adsorbed configurations are physisorption expecting the CO adsorbed at the modified Ti top position in (001) surface behaved as chemical adsorption. In order to understand the mechanism of the adsorption, the difference of electron density before and after adsorption process was analyzed. Moreover, the diffusion of CO molecule on the TiO_2 anatase surfaces have been investigated using transition state search (TS Search) calculations. It is found that CO can easily diffuse on TiO_2 anatase surfaces with small barrier energy among physisorption positions, while it is difficult to diffuse from chemical adsorption to physisorption positions and reverse. The impact of CO molecule adsorption on the density of states (DOS) was also disused in the report.

P15-FPM

Photo-thermal conversion characteristics of carbon nanotubes dispersion in Bitumen for direct Solar thermal energy absorption applications

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Today's population growth and increasing dependency of industry and technology on fossil energy encounters all countries and communities with challenge of energy for future. Hence researches about renewable energies, especially solar energy are considered. The efficiency and effectiveness of solar energy capture and storage are to a large extent functions of the heat transfer and storage capacity of the medium used. Bitumen is a material that widely used in road construction, roofing system, waterproofing and has potential application in solar absorption. Many research works have been implemented to modify its specifications. Nanosized particles have been used in numerous applications to improve various properties; one of the promising additives is the use of carbon nanotubes (CNTs). In this study, CNTs were mixed with bitumen by using functionalization and mechanical stirrer method. The softening point, thermal conductivity and the photo-thermal conversion characteristics of bitumen/CNTs have been investigated. The results suggest that the presence of CNTs helped improving the thermal properties and the photo-thermal conversion of the bitumen/CNTs material. The initial results showed the potential application of bitumen/CNTs in construction and solar absorption in the future.

P16-FPM

Study on crystal structure and magnetic properties of $La_{0.8}R_{0.2}(Fe_{0.88}Si_{0.12})_{13}$ (R = Y, Sm, Tb, Ho and Yb) alloys

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The study presents the results on crystal structure and magnetic properties of compounds $La_{0.8}R_{0.2}(Fe_{0.88}Si_{0.12})_{13}$ (with R = Y, Sm, Tb, Ho and Yb). All the samples were prepared by using an arc-melting method in argon atmosphere. Crystal structure of compounds was studied by X-ray diffraction, and the result showed that after being heat-treated, the samples existed $NaZn_{13}$ phase and small α-Fe phase. The magnetic properties of compounds were determined by magnetization versus temperature M(T) and field M(H). The result also indicates the effect of replacing partly Lantan by rare earth on the structure and magnetic properties of the compound. The lattice parameter decreased in rare earth in accordance with the phenomenon of compressing La and especially the transition temperature increased significantly when La was replaced by the heavy rare earth element. Magnetic entropy change $-\Delta S_M$ has reached 5.8 J/kg K for $La_{0.8}Y_{0.2}(Fe_{0.88}Si_{0.12})_{13}$, and the relative cooling power (RCP) is 102 J/kg for $La_{0.8}Sm_{0.2}(Fe_{0.88}Si_{0.12})_{13}$.

P17-FPM

Structural, magnetic and magneto-caloric properties of $MnFeSe_{0.25}P_{0.75-x}Ge_x$ (x =0.08, 0.1, and 0.12) intermetallic compounds

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Structural, magnetic and magneto-caloric properties of $MnFeSe_{0.25}P_{0.75-x}Ge_x$ (x=0.08, 0.1, and 0.12) intermetallic compounds have been prepared by a several- step solid state reaction method investigated for possible applications in magnetic refrigeration. The morphology, structure, composition and thermal stability of the as-synthesized intermetallic compounds are characterized, analysed and confirmed by XRD, FE-SEM, EDS, DSC and TGA, respectively. These characterizations revealed that the successful synthesis of the intermetallic compounds with pure crystalline phase of hexagonal Fe_2P-type structures of the intermetallic compounds. VSM, SQUID magnetometer and Impedance Analyzer have been used for magnetization measurements of the samples with temperature and magnetic field variation in room temperature to 400 K, liquid nitrogen temperature and magnetic field range of 0–7 T. Saturation magnetization, Phase transition temperature, specific heat capacity and magneto-caloric properties have been investigated and analysed from these measurements from which it is found that the magnetization is strongly dependent on P/Ge ratio change.

P18-FPM

Magnetic properties of $La_{0.7}Ca_{0.3-x}Sn_xMnO_3$ ($0 \leq x \leq 0.1$) compounds with a second-order phase transition

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In this work, we have investigated the magnetic entropy changes and MCE [1-5] in $La_{0.7}Ca_{0.3-x}Sn_xMnO_3$ compounds which were prepared by a conventional solid-state reaction method. Three samples of $La_{0.7}Ca_{0.3-x}Sn_xMnO_3$ compounds were pressed into pellets at 200 ℃. Magnetization measurements versus temperature revealed a decrease of the ferromagnetic–paramagnetic phase transition temperature (*Tc*) with increasing Sn-doping content. The T_C values are found to be 176, 171, and 164 K for x = 0.02, 0.04, 0.1 samples, respectively. Based on the magnetic field and temperature dependences of magnetization, we show these compounds undergoing a second-order magnetic phase transition. Additionally, the magnetic entropy change (ΔS_m) of samples under an applied magnetic field of 10 kOe was calculated by using the isothermal magnetization data. We have found the maximum magnetic entropy change ($|\Delta S_{max}|$) and full width at half maximum (δT_{FWHM}) of $\Delta S_m(T)$ curves for all the samples. These values are $|\Delta S_{max}|$ = 1.65, 1.27, and 1.24 J kg^{-1} K^{-1}, and δT_{FWHM} = 35.1, 42.9 and 46.1 K for x = 0.02, 0.04, 0.1 samples, respectively. The relative cooling power (*RCP*) values are thus about 56.4, 50.9, and 49.9 J $kg^{-1}$for x = 0.02, 0.04, 0.1 samples, respectively, which are comparable with the values of some magnetocaloric materials.

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P19-FPM

Influence of Pr-doping on magnetic properties and magnetocaloric effect of $La_{1-x}Pr_xSr_{0.3}MnO_3$ compounds (x=0, 0.3, 0.5, 0.7)

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In this work, the magnetic and magnetocaloric properties of of $La_{0.7-x}Pr_xSr_{0.3}MnO_3$ polycrystalline compounds with x=0, 0.3, 0.5 and 0.7 prepared by a standard solid-state reaction method are investigated. The compounds undergo a second order phase transition that Curie temperature decreases with increasing Pr content from 372, 341, 303 to 264 K when x varies from 0, 0.3, 0.5 to 0.7. Entropy change increases but relative cooling power (RCP) of compounds varies little with increasing doping concentration. The maximum values of entropy change occur near FM-PM phase transition points and are found to be $-\Delta S_{max}$ ~ 4.5, 4.6, 5.6 and 6.4 J/kg·K with an applied field change of 5 T for x = 0, 0.3, 0.5 and 0.7, respectively. The field dependences of ΔS_{max} and RCP obey the power law where field exponents n=0.603-0.746 and N=1.107-1.22. The critical exponents found by modified Arrott plots are β=0.318±0.002, γ=1.123±0.021, and T_C≈368 K for x=0; β=0.342±0.007, γ=1.07±0.02, and T_C≈336 K for x=0.3; β=0.281±0.005, γ=0.948±0.005, and $T_C \approx$ 301 K for x=0.5; β=0.294±0.005, γ=1.112±0.032, and T_C≈265 K for x=0.7. The result shows a state of ferromagnetic inhomogeneity in compounds with critical exponents deviated from 3D-Ising model type.

P20-FPM

Magnetocaloric effect in Gd_2O_3 nanofibers

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The magnetocaloric effect of *C*-type cubic gadolinium oxide Gd_2O_3 and Fe:Gd_2O_3 nanofibers with large length-to diameter aspect ratio has been studied. The Gd_2O_3 nanofibers of 20-30 μm long and 40-100 nm in diameter were synthesized by electrospinning method. A superparamagnetic behavior going with a weak anti-ferromagnetic state was observed with the effective moment ~ 7.72 μ_B. Gd_2O_3 fibers exhibited a large entropy change of 28 J/kg·K at cryogenic temperature of 5 K with a field change of 7 T. However, magnetocaloric effect significantly decreased with the presence of Fe in Gd_2O_3 nanofibers. Entropy change in Fe-doped samples was almost unchanged at various iron concentration (2-3 at.%) but it was halved compared with undoped sample.

P21-FPM

Magnetic and magnetocaloric properties of polycrystalline $Pr_{0.7}Ba_{0.1}Sr_{0.2}MnO_3$

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In this work, we present the magnetic and magnetocaloric properties of $Pr_{0.7}Ba_{0.1}Sr_{0.2}MnO_3$ polycrystalline prepared by solid state reaction. Rietveld refinement of room temperature powder X-ray diffraction pattern showed that sample crystallized in the monoclinic structure with a=5.4726 Å, b=5.5045 Å, c=7.7339 Å, α=γ=90°, and β=90.003°. A ferromagnetic-paramagnetic phase transition at 232 K belongs to the second-order type based on Banerjee's criterion. Moreover, a further analysis on critical behavior using the modified Arrott plots method showed that magnetic behavior in $Pr_{0.7}Ba_{0.1}Sr_{0.2}MnO_3$ is close to a tricritical mean-field model and critical exponents were found to be β≈0.234, γ≈0.949 and T_C≈233 K. This means there is an existence of a short-range magnetic ordering in compound.

Magnetocaloric effect of $Pr_{0.7}Ba_{0.1}Sr_{0.2}MnO_3$ was evaluated by magnetic entropy change, which was calculated indirectly from isothermal magnetization data using Maxwell's relation. The maximum entropy change ($-\Delta S_{max}$) was found to be 5.6 J/kg.K near phase transition point with field change of 5 T. The universal master curve analysis what describes a good convergence of $|\Delta S_M|/|\Delta S_{max}|$ versus θ curves in a reduced coordinates system confirmed a second-order phase transition in $Pr_{0.7}Ba_{0.1}Sr_{0.2}MnO_3$ compound.

P22-FPM

Synthesis and characterization of magnetic properties of nanocrystalline perovskite $Eu_{1-x}La_xFeO_3$ (x = 0.0 – 1.0)

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Nano perovskite $Eu_xLa_{1-x}FeO_3$ ($0 \leq x \leq 1$) was prepared by gel – citrate method. The sample $EuFeO_3$ was manufactured at different rates of acid citric (AC) and total ions (M^{n+}) as 0.8; 0.9; 1.1; 1.3; 1.5. The sample at a rate of 1.3 is single phase. The X-ray diffraction and IR spectra show that the structure of crystal changes from cubic to orthorhombic. Average size of particles equals to 19nm and decreases with increasing La-doped level. A study of the magnetic properties shows that these materials are weakly ferromagnetic, in association with superparamagnetism. The ratio of magnetic remanence and saturation Mr/Ms is nearly zero. The magnetic properties of the materials varying with increasing the unit volume prove that magnetic properties depend on crystal distortion of the materials.

P23-FPM

EXAFS cumulant investigation of thermal disorder in iron monosilicide alloy

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In this work, we develop the anharmonic correlated Debye model to explore the thermal disorder in iron monosilicide (FeSi) alloy by analyzing the extended X-ray absorption fine structure (EXAFS) cumulants. The analytical expressions of uncorrelated atomic mean-square displacement and the first-four EXAFS cumulants as functions of temperature and constituent concentration have been derived. Numerical calculations have been performed for Fe-25 at.%Si up to 900~K using the Albe-Erhart-Tersoff bond order potential based the original Brenner formulation. Our results are compared with those of available experimental data showing the good and reasonable agreements. Our research shows in detail that the zero point vibrations contribute importantly to EXAFS cumulants at low temperature (the quantum effect), and the thermal disorder of atoms is significant at high temperature (the anharmonicity effect). The temperature-dependent electrical resistivity of FeSi has also been estimated through the Bloch-Grüneisen law by using the derived Debye temperature.

P24-FPM

Effect of Na-substitution on the ordering of Cu-O layer and interlayer coupling of the $Bi_{1.6}Pb_{0.4}Sr_2Ca_{2-x}Na_xCu_3O_{10+\delta}$ superconducting system

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This study deals with the effect of Na-substitution on the local structure and the dimensional fluctuation of the superconducting order parameters in Bi-2223 superconductor. The Bi-2223 phase superconductors with nominal composition of $Bi_{1.6}Pb_{0.4}Sr_2Ca_{2-x}Na_xCu_2O_{10+\delta}$ (x = 0.0 to 0.6) were prepared by the standard solid-state reaction method. The Cu K-edge X-ray absorption spectra (XANES/XAFS) were analyzed to examine the distance and the static disorder of Cu-O bonds. Analysis from the extended X-ray absorption fine structure (EXAFS) measurements showed decreases in both the Cu-O distance and the local oxygen disorder around Cu atoms with increasing Na concentration. The fluctuation dimensionality deduced from the conductivity analysis was determined by using the Aslamazov-Larkin (AL) theory. It is found that all the samples show 2D to 3D conductivity transition; increase in 2D to 3D crossover temperature T_{LD} with increasing the Na concentration. In addition, the interlayer coupling strength in Bi-2223 system tends to increase with Na concentration. These results indicate that the Na substitution in Bi-2223 system effectively increases the ordering of Cu-O bonds and strengthens the Cu-O interlayer coupling coinciding with enhanced T_c.

P25-FPM

Monte Carlo simulation for the Shastry-Sutherland lattice with disorder

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We investigate disorder effects using Callen identities on the Ising model with anti-ferromagnetic (AF) spin couplings in the Shastry-Sutherland lattice. The simulation results indicate that the field-dependent magnetization curve of the classical Ising model consists of only one main magnetization plateau with the fractional magnetization $m/m_s = 1/3$ (the saturation magnetization m_s) without disorder. In the inclusion of disorder, the fascinating sequence of magnetization plateau is surprisingly found with fractional values depending on the disorder probability of the AF exchange interaction between nearest neighbor and next nearest neighbor sites. Our results imply that dynamical mechanism driven by disorder arises multi-steps in the field-dependent magnetization curve which are experimentally observed in many compound as $SrCu_2(BO_3)$ and the rare-earth tetraborides RB_4 (R = Tm, Ho, Er).

P26-FPM

A DFT – based study on the Structure and Electronic Properties of $LaGaO_3$ – based perovskite

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We performed density functional theory (DFT) based calculations to investigate the structure and electronic properties of pristine/stoichiometric $LaGaO_3$ (LG) -based perovskite. Firstly, pristine LG was carried out to study how the presence of O-vacancies affects structure properties, electronic characteristics and O – migration. The results showed that we can promote O-migration through an initially inert LG by introducing O-vacancies at the equatorial positions along the ac-plane of the $[GaO_6]$ octahedrons, resulting in O-deficient LG. And, it is easier for O ions to migrate through $LG_{-\delta}$ via the equatorial edges of the $[GaO_6]$ octahedrons. Secondly, in order to lowering activation energy, study on doping compounds was also performed in details.

P1-AMD

Multifunctional Fe_3O_4-ZnO nanocomposites: synthesis and properties for applications in wastewater treatment

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Multifunctional Fe_3O_4-ZnO nanocomposites were synthesized by a simple and efficient method. Firstly, magnetite (Fe_3O_4) nanoparticles are prepared by co-precipitation method and functionalized with amin groups by hydrolysis – condensation reactions of (3-aminopropyl) triethoxysilane. Then, the Fe_3O_4-ZnO nanocomposites are achieved via adsorption and co-precipitation of zinc ions on the surface of magnetic nanoparticles functionalized amin group. The nanoparticles' structure, morphology, composition, optical and magnetic properties have been investigated by many techniques. The results demonstrate the successful synthesis of Fe_3O_4-ZnO nanocomposites with ZnO adhering to around of Fe_3O_4 nanoparticles. The as-prepared Fe_3O_4-ZnO nanoparticles simultaneously exhibit UV wavelengths absorption, visible light emissions and superparamagnetic property suitable for photocatalysis, adsorption and purifications in wastewater treatment.

P2-AMD

Lipid monolayer a promising candidate for gate dielectric in bioFETs and biosensors

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There has been a broader interest in developing biosensor recently. Many biosensing technologies have been developed in which field-effect transistor (FET)-based biosensors have been proven to outperform others by their attractive features, especially for ultra-sensitivity detection, capability for mass-production, and low manufacturing cost. However, the BioFET needs to satisfy two main requirements that are the possibility to access very low sensitivity and to get low operating voltage (below 3V) to prevent molecular damages. In this work, we fabricated a fabricated MOS-type FET using a lipid monolayer as a dielectric gate. It has been shown that a 3 nm lipid monolayer exhibited excellent insulating behaviour as an insulator gate. The source leakage current remained below 10-9 A with an electric field intensity of as high as 5 MV/cm. The characteristics of the MOS-FET device using such insulator showed a very good sensitivity of the drain current even at low gate-source voltage. The experimental threshold voltage value is in good agreement with that of the ideal theoretical one, when the dielectric and interfaces fixed charges are considered as negligible. The obtained results demonstrate that the density of electrical traps at the lipid monolayer silicon interface is low.

P3-AMD

Half-Heusler HfCoSb alloy a novel material for thermoelectric applications

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Density Functional Theory (DFT) in clubbing Boltzmann semi-classical transport equation (BTE) have been used to investigate the electronic, and thermoelectric properties of HfCoSb type half-Heusler compounds. An effective exchange potential functional developed by Tran and Blaha by modifying Becke-Johnson potential employed to obtain the accuracy in band gap. The calculated results are in qualitative agreement with the available reports. HfCoSb shows a narrow indirect band gap with electron transition along Γ-X symmetry point in the first Brillouin zone. The electronic parts of thermoelectric parameters like Seebeck coefficient, electrical conductivity, and thermal conductivity are calculated from Boltzmann semi-classical transport equation (BTE).

P4-AMD

Multichannel smartphone based spectrometer and its application in analyzing enhancement of photocatalytic degradation of methyl blue by Zinc oxide nanorods

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We report on the adaption of a smartphone to function as a multichannel spectrometer that can measure transmission and absorption spectrum. The spectrometer was constructed by implementing several external light sources, collimation lens, a diffraction grating, and a CMOS chip of a smartphone as a detector. The construction allows the spectrometer can measure four samples at a time while still maintains its optical bandwidth of 300 nm (from 400 to 700 nm) and its resolution of 0.26 nm/pixel. As a proof of concept, the multichannel smartphone based spectrometer is then applied to investigate the enhancement of photocatalytic degradation of methyl blue by zinc oxide nanorods. Despite of its cost-effectiveness, the spectrometer exhibits reliable results, which can be considerably comparable with that of laboratory instrument.

P5-AMD

Optimizing oriented anti-AFP on screen-printed carbon electrode in developing immunobiosensor for AFP antigen detection

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Orientation of antibodies on solid-state surface has an important role in the performance of immunoassays. The sensitivity of immunoassays depends on antibody presentation that requires the antigen binding sites to be directed toward the solution phase. In ideal case, the Fc (fragment crystallization region) part of the immobilized antibody would be substrate facing. However, there could be some other surface orientations including "head-on," "side-on," and "lying-on". In the case of "head-on" orientation (i.e. the Fc part of the immobilized antibody is oriented to face electrode surface), there will be a resistance for antigen binding. In the other cases of "lying-on" or "side-on", even if the epitote region is oriented toward the solution. This pattern reduces the quantities of antibody bound on the electrode surface due to their larger size compared to the receptor (chemical binding) on the electrode. Only orientation of type "end-on" (i.e the carboxyl group of antibodies is oriented toward electrode surface) can make optimized conditions for antigen binding. Therefore, in this work, we find optimal conditions to immobilize monoclonal antibody AFP onto screen-ptinted carbon ink electrode (SPCE) via p-ATP self-assembled monolayer and poly(aminolthiophenol) layer. These layers contain the positively charged -NH_2 group. Under our optimal conditions, the designed immunosensor of the case "end-on" exhibited a wide linear range from 0.1 to 100 ng mL^{-1} with a detection limit of 0.14 ng mL^{-1} (S/N = 3) for AFP antigen detection. The designedimmunosensor also has high selectivity and reproducibility for potential applications in clinical monitoring of AFP antigen.

Presenter: T.N.-Lien TRUONG

P6-AMD

Electrochemical synthesis of flower-like gold nanoparticles for SERS application

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Surface-enhanced Raman spectroscopy (SERS) is a technique that is increasingly used in the identification of organic molecules at very low concentrations. In this analytical technique, the SERS-active substrates play a crucial role. Beside silver, gold is also used widely in the manufacture of SERS substrate. In this report we present a simple method for fabricating an array of flower-like gold nanoparticles (also reffered to as gold nanoflowers - AuNFs), which can be used as SERS substrate. The AuNFs have been electrodeposited on a silicon surface coated with silver nanoparticles, which act as seeds for the growth of gold nanoflowers. The results show that AuNFs have been formed on the silicon surface with relatively dense density and with an evently distribution. The AuNFs arrays, as the SERS substrates, were tested with molecular rhodamine B (RhB) probe. The results showed that these AuNFs allow the detection of RhB down to a concentration of 1 ppb, a relatively low concentration. This demonstrates the applicability of fabricated AuNFs as a highly active SERS substrate.

P7-AMD

Front-end circuit design for multiplication point kP (233-bit) based on elliptic curve algorithm

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Key exchange protocol over multiplication point kP (233 bit) based on elliptic curve was used widely in information security applications, such as digital sign, ecommerce or Token device, etc. It attracted a lot of research, which brings out system applications and software to reality. At the moment, front-end design for multiplication point (233-bit) kP based on elliptic curve algorithm circuit using standard cells in core fabrication has not been implemented. In this paper, a novel circuit design and layout of multiplication point kP (233 bit) based on elliptic curve algorithm using cells from FreePDK 45 nm were presented. The power consumed was 1406.3 mW, a total number of 36530 cells occupied 0.119 mm^2.

P8-AMD

Visible light induced photocatalytic degradation of Rhodamine B of Ni-doped TiO_2 nanocrystalline powders

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This paper reports the synthesis of various molar concentrations of Ni-doped TiO_2 nanopowders ($Ni_xTi_{1-x}O_2$, x = 0.005, 0.01, 0.02, 0.03, 0.05, 0.08) and their efficient use as potential photocatalysts for visible light photocatalytic degradation of rhodamine B, a toxic and harmful chemical substance. The Ni-doped TiO_2 nanopowders were synthesized by sol-gel method. The effects of Ni doping on structural and visible-light photocatalyst properties of TiO_2 nanopowders were investigated. The phase of synthesized nanopowders was investigated by x-ray diffraction method. The synthesized nanopowders showed a mixture of anatase and rutile phase. The morphology and particle size of powders were observed by scanning electron microscope. The photocatalytic activity of the prepared nanopowders under visible light irradiation has been tested in the degradation of rhodamine B from water. The maximum degradation rate observed was 76 % in 140 min under light irradiation when the Ni molar doping concentration was 1 mol.%, without addition of any oxidizing reagents.

P9-AMD

Fabrication of WO_3/MWCNTs hybrid nanomaterials for room temperature NH_3 gas sensors

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WO_3/MWCNTs hybrid nanomaterials were fabricated by using MWCNTs grown via CVD method and monoclinic WO_3 nanoparticles synthesized via hydrothermal treatment. The composed materials were used for room temperature - NH_3 gas sensing application. The sensors showed higher sensitivity and selectivity to the NH_3 gas than the MWCNTs or WO_3 based sensors. A possible mechanism explaining the behavior of hybrid sensors is introduced.

P10-AMD

Staphylococcus aureus behaviors in the citric acid environment using a 3D printed AFM fluid cell

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Staphylococcus aureus is classified as a gram-positive bacterium, which is a very common human pathogen, that enters the body via broken skin or mucous membranes, such as a nosocomial infection of surgical wounds in hospitals all around the world, as the molecular mechanisms of pathogenesis are increasing every day. Additionally, citric acid is known as an organic acid with the commercially valuable microbial product used primarily in the foods/beverages, pharmaceutical/chemical, textile, and electroplating industries, where it is used as a flavor enhancer, preservative, chelating agent, and antioxidant. Therefore, numerous studies show that citric acid has antimicrobial activity against a wide spectrum of bacteria, such as Escherichia coli, Enterococcus faecalis. Thus, Staphylococcus aureus behaviors were investigated in citric acid condition by Atomic Force Microscopy (AFM). More interestingly, a 3D printed AFM fluid cell was performed to develop an experiment for studying the effect mechanism of citric acid to bacterial surface properties through adhesion, deformation, and modulus.

P11-AMD

Photocatalyst of ZnO nanorods decorated with Au nanoparticles

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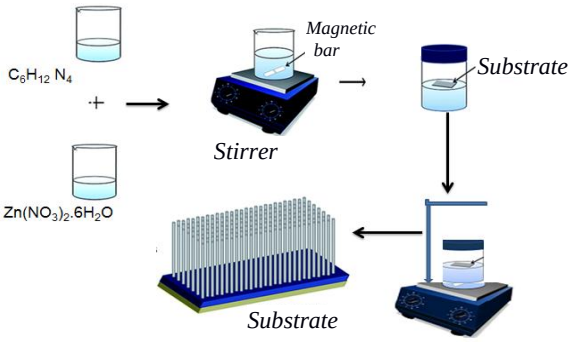

Zinc oxide is a widely known material with valuable characteristics: wide direct band gap of 3.3 eV, large exciton binding energy of 60 meV, high efficient photocatalyst… Therefore, ZnO has been applied in many fields such as: optical devices (LEDs, laser), solar cells and sensors. This material is also appealing due to diversity of available processing methods including both chemical and physical approaches such as: hydrothermal, sol-gel, chemical vapor deposition and sputtering. Various low dimensional structures of ZnO in terms of nanoparticles, nanorods, nanoneedles, nanotetrapods find many applications in technology and life. In this report, ZnO nanorods are prepared by hydrothermal assisted with galvanic effect. Effect of hydrothermal time on the obtained product was studied. The as prepared nanorods were then decorated with gold nanoparticles by sputtering. ZnO/Au nanoproducts show excellent photocatalyst activities which was demonstrated by complete photodegradation of methylence blue under UV irradiation.

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P12 – AMD

Chemical sensing by surface enhance Raman scattering on ZnO nanorods decorated with gold nanoparticles

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Thanks to unique Raman spectra of chemical substrances, a growing number of applications in environmental and biomedical fields based on Raman scattering has been developed. Howerver, the low probability of Raman scattering hindered its potential development. Different techniques were developed to enhance Raman signal, which can be named as resonance Raman, tip-enhanced Raman scattering and especially surface enhanced Raman scattering (SERS). A key step of surface enhanced Raman scattering technique is to prepared active SERS substrate from noble metals. The main enhancement mechanism is electromagnetic enhancement resulted from surface plasmon resonance. During early stage, SERS substrates were made from rough metallic electrodes, until they are replaced by noble nanoparticles based substrates. The disadvantages of nanoparticles based SERS substrates include high randomness due to self-assembly process of nanoparticles. Recently, a new kind of SERS substrates was proposed to take advantages of order nanostructures of semiconductors. In combination with noble metals, these nanostructures can served as active SERS substrates, which are expected to possess high enhancement factor with high repeatability. In this study, ordered ZnO nanorods were first prepared by galvanic hydrothermal method.

Gold, which is a commonly used noble metal in SERS substrates because of outstanding benefits such as chemical inert, high stability and surface plasmon resonance frequency of nanoparticles in visible range, was then sputtered on the as-prepared nanorods. The results showed that thickness of shell layer play a critical role on SERS activity. Our SERS substrate exhibit high enhancement factors, and can detect chemical substances at concentration in the nano molar range.

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P13-AMD

Influence of ZnO nanorods on sensitivity of wireless passive LC temperature sensor fabricated by printed circuit board (PCB)

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In this research, a wireless passive LC temperature sensor was designed and fabricated by one metal layer of printed circuit board (PCB). The principle of this sensor is based on the resonant frequency of the LC circuit. When environment's temperature changes leading to dielectric of PCB change, the capacitance of LC circuit change, thus the resonant frequency of this LC circuit is also change. To measure the variations of this resonant frequency, an E6061A Network Analyzer instrument was used to conduct. The sensitivity of an original LC temperature sensor based on PCB was estimated to be 19.7±1.2 kHz/^{0}C. In order to improve sensor's sensitivity, ZnO nanorods (NRs) were covered on Capacitance part of LC circuit by hydrothermal process. The microstructural characteristics of the asgrown ZnO NRs were investigated by x-ray diffraction analysis confirming the hexagonal wurtzitestructured of ZnO. SEM images revealing the morphology of the synthesized ZnO NRs with hexagonal and columnar sharp. By using ZnO NRs, the sensitivity of this sensor was improved to be 32.92

P14-AMD

Study of microwave absorption properties of manganese-nickel-zinc ferrite – reduced graphene oxide – polyaniline nanocomposite

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Le Quy Don Technical University

Ternary composites composed of reduced graphene oxide, manganese-nickel-zinc nanoparticles and polyaniline were synthesized the highly efficient absorption of microwave. The morphology, structure and other properties of composite materials were characterized by SEM, TEM, XRD, FTIR and VSM techniques. The complex permittivity, permeability and reflection loss value were studied by using the vector network analyzer, in the frequency range from 8 to 12 GHz. The result shows that microwave absorption property and the bandwidth of absorption of ternary composites was found to improve comparison to single and bi-component materials.

P15-AMD

A label-free DNA sensor based on a microcantilever platform

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In this work, we report the application of microcantilevers for the development of highly sensitive label-free sensors in DNA detection. The operation of microcantilever-based DNA sensors is achieved from a combination of the traditional DNA hybridization approach and the nano-mechanical analysis. The change of nano-mechanical vibrations, caused by DNA hybridization on the microcantilever surface, was recognized by using the optical lever method with the Scanning Laser Analyzer (SCALA). This approach is considered as a nondestructive testing technique for the effective DNA detection.

P16-AMD

Fabrication of molecularly imprinted polyaniline based electrochemical sensor towards the detection of antibiotic residue

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Molecularly imprinted polymers (MIPs) are considered as highly selective polymeric materials that used in applications such as chemical separations, catalysis, or molecular sensors. In this work, MIP nanowires were deposited on the gold electrode by electro-polymerization of aniline monomer in the presence of chloramphenicol (CAP) as the template molecule. The removal of the template from MIP was electrochemically employed to generate the cavities on the polyaniline matrix, which enables the specific recognition of CAP. The morphological, structural and electrochemical properties of the MIP were characterized by SEM, FT-IR and cyclic voltammetry. The analytical performance of the MIP-based sensor was evaluated through differential pulse voltammetry, which shown a wide linear range from 10^{-8} M to 10^{-3} M for CAP in the aqueous medium. The minimum concentration of CAP was experimentally determined at 10^{-8} M (3 ppb).

P17-AMD

Magnetocaloric microwires for energy-efficient magnetic refrigeration

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Magnetic refrigeration based on the magnetocaloric effect (MCE) has enabled a future green cooling technology. There are many factors that determine the cooling efficiency; one of which is the dimesion of the magnetic refrigerant used. While shaping magnetic refrigerants in the form of spherical or irregular particles is energy-inefficient, the use of the wires with increased surface areas allows for a higher heat transfer between the magnetic refrigerant and surrounding liquid. In this paper, we report on the structural, magnetic, and magnetocaloric properties of some high-quality Gd-based alloy microwires systems with an average diameter of ~40 μm, which were fabricated by the melt-extraction method. In the first system, the high-quality $Gd_{60}Fe_{20}Al_{20}$ microwires, magnetization measurements revealed a broad paramagnetic to ferromagnetic phase transition at T_C ~ 202 K. For $\mu_0\Delta H$ = 5T, the microwires exhibit a broad magnetic entropy change with its maximum value ΔS_M^{max} of ~4.8 J kg^{-1} K^{-1} and a large refrigerant capacity (RC) of ~ 687 J kg^{-1} over a large temperature interval (150 K). In the second system, the high-quality amorphous $Gd_{50}(Co_{69.25}Fe_{4.25}Si_{13}B_{13.5})_{50}$ microwires undergo a second-order paramagnetic to ferromagnetic (PM-FM) transition around the Curie temperature, T_C ~173 K. Around the PM-FM phase transition temperature, the magnetic entropy change reaches a maximum value ΔS_M^{max} of about 5.92 J/kg K for $\mu_0\Delta H$ = 5T. The critical behaviors near the PM-FM phase transition are discussed.

P18-AMD

Stability mechanism of perovskite solar cell

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We demonstrate degradation mechanism of $CH_3NH_3PbI_3$ Perovskite solar cells (PSCs) and their recovering effects by introducing CH_3NH_3I layers. After degradation by exposing to air under 1 sun condition for 18 hour, the $CH_3NH_3PbI_3$ perovskite absorption between 530 and 800 nm decreases, and thereby the energy band gap increases. The X-ray diffraction (XRD) patterns indicate that the moisture with sunlight corrodes $CH_3NH_3PbI_3$ perovskite into PbI_2, which generates the crack-like voids on the surface of the illumination-degraded $CH_3NH_3PbI_3$ perovskite thin films. As a result, the PSC photovoltaic performance is degraded and the power conversion efficiency (PCE) is reduced from 16.8 to 0.7%. However, the PCE is recovered to 7.6% by introducing CH_3NH_3I layer to the illumination-degraded $CH_3NH_3PbI_3$ perovskite thin films. Recovering of the $CH_3NH_3PbI_3$ perovskite absorption between 530 and 800 nm and the $CH_3NH_3PbI_3$-perovskite-assigned peaks in the XRD patterns verifies that the illumination-degraded PbI_2 is recombined with spin coated CH_3NH_3I, and the $CH_3NH_3PbI_3$ perovskite structure is recrystallized [1].

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P19-AMD

A newly designed ferromagnetic microwire solenoid sensor for motion tracking and biosensing applications

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The high frequency GMI effect is a sensitive phenomenon found in amorphous, soft ferromagnetic materials. The GMI effect has potential to introduce a new class of long range, contact-free small field magnetic sensing [1]. GMI sensors allow for low-cost, robust systems capable of a wide range of motion tracking applications. A challenge these sensors present to applications comes from the quick decay of magnetic field lines, restricting their sensing distance. In an attempt to achieve better sensitivity and longer ranges, Cobalt-based microwires have been wound into solenoids around Plexiglas molds with various lengths of wire. Further, the number of turns used, affects the magnitude and frequency of transmission line resonance. GMI responses were measured around resonance to determine the optimal operating frequency for each sensor and to observe the relation to the circuit's current nodes. Of the solenoids constructed, the 12 turn, 203 mm solenoid had the highest sensitivity. The optimal operating frequency was 32.4 MHz, which allowed for a range of 250 mm. For comparison, GMR sensors have a detection range of 190 mm [2]. This newly developed sensor finds wide ranging applications in industry and bioengineering.

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P20-AMD

Characterization on Cu doped ZnO thin films prepared by solution processing

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Cu doped ZnO (CZO) thin film has been attracted a lot of attentions owing to its potential application for solar cell or field-effect transistor devices. In this work, the CZO thin films with various doping concentrations such as 0%, 0.5%, 1.0%, 1.5% and 2.0% are successfully prepared on glass substrates by using a solution process. The annealing temperatures are, in turn, changed to be 400^{o}C, 450^{o}C, and 500^{o}C for each concentration condition. XRD patterns show that the CZO thin films are oriented along with (100), (002) and (101) preferred planes. The best crystallization is corresponded to the 0.5% dopant concentration, and annealing temperature of 500^{o}C. SEM observation indicates that the grain size is relatively uniform, but some porous spaces existed. One obtained that the grain size decreases with the increase of doping concentration, but increases with the increase of annealing temperature. Optical analysis points out that the CZO thin films absorb most strongly at wavelengths in a range from 350 to 375 nm, corresponding to bandgap energies ranged from 3.13 to 3.24 eV. Further investigation on electric properties will be also presented and discussed at the symposium.

P1-NM

On-chip growth of tin oxide nanowires DNA sensor

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We report about a biosensor based on tin nanowires (SnO_2 NWs) for determination of DNA. A very simple method is to fabricate SnO_2NWs on chip by one-step. SnO_2Nws were prepared by chemical vapor deposition (CVD) using shadow mask. SnO_2NWs grew on gold electrodes by the thermal vapor deposition method at 750°C. Nanoparticles Au catalysts were active under hight temperature. These SnO_2NWs were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and Raman-scattering spectroscopy. XRD indicated that the products were tetragonal SnO_2NWs having polycystaline structure with lattice parameters of a = 4.7 Å and c = 3.1 Å. UV-Vis absorption spectra showed the optical band gaps of 3.8 eV for the SnO_2NWs. Raman spectra of the samples show three vibration modes at 473.2, 628.8 and 775.8 cm^{-1}. TEM result shows gold thin film at the root and gold nanoparticles at the tip of SnO_2NWs. In this work, SnO_2NWs-DNA was created by conjugating the SnO_2 NH_2 with ss-DNA. The measurement of DNA hydribization was performed at room temperature by using SR830 DSp lock-in amplifier. Fabricated biosensor showed a high response to 10 pM of DNA molecules.

P2-NM

Synthesis and properties of superparamagnetic–plasmonic nanoparticles Fe_3O_4@SiO_2-Au for applications in biomedicine

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Superparamagnetic – plasmonic multifunctional nanoparticles Fe_3O_4@SiO_2-Au are attracted many researchers in the world. These nanoparticles simultaneously contain two components: Fe_3O_4 nanoparticles with high saturation magnetization approximately 63 emu/g and Au noble metallic nanoparticles with surface plasmonic resonance at 550 nm. Moreover, Au noble metallic nanoparticles on the surface of Fe_3O_4@SiO_2 were functionalized with amin group for capturing cancer cells and labeling in biomedicine by surface-enhanced Raman scattering signals.

P3-NM

The effect of potential applied on magnetic nanoparticles fabrication process by sonoelectrodeposition method

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Sonoelectrochemistry was developed to make nanoparticles. It combined the advantages of sonochemistry and electrodeposition. NiFe nanoparticles were prepared by sonoelectrodeposition method at room temperature with potential applied in rang 3 - 8 V. The mechanism process and electrochemical potential of NiFe were determined by cycle voltammetary. The crystalline structure and morphology of the samples were characterized by X-ray diffraction (XRD) and Scanning Electron Miroscopy (SEM), respectively. The concentration of the films was determined by EDS. The hysteresis loops were measured at room temperature using vibrating sample magnetometer (VSM). By VSM measurement, the maximum Hc values were approximate 25.18 to 50.5 Oe when diameter decreased from 250 to 85 nm. From XRD spectrum, $Ni_{71}Fe_{29}$ nanoparticle represented (111) face-centered cubic structure with lattice constant a = 0.35 nm. The ultrasonic frequencies are also affected to the process of creating granulation and particle size of NiFe nanoparticles.

P4-NM

Optical properties of ZnSe nanoparticles

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Institute of Materials Science,Vietnam

ZnSe nanoparticals (NPs) have been chemically synthesized by a hydrothermal method at 190 ^{o}C ^{0}C for 20 hours with the Zn:Se molar ratio of 1:1. The resulting ZnSe NPs possessed zinc blende structure, spherical morphology, and small size of 40 nm, as characterized by x-ray diffraction (XRD) analysis, Raman spectroscopy, and highresolution transmission electron microscopy (HR-TEM). The absorption (Abs) and photoluminescence (PL) spectra of the ZnSe NPs show the highest quality of the ZnSe NPs. The PL peak of the ZnSe NPs shifted to shorter wavelength, and the corresponding intensity increased with decreasing temperature in the range of 15 K to 300 K.

P5-NM

Synthesis of ZnSe nanocrystals by hydrothermal method for solid lighting

Bui Thi Thu Hien, Tran Thi Thương Huyen, Nguyen Thu Loan and Tran Thi Kim Chi

Institute of Materials Science, Vietnam

In this paper, we present the results of the syntheses of large-scale ZnSe nanocrystals (NCs) with high quantum yield via a simple and low cost hydrothermal method. The influences of the synthesis parameters, namely the Zn:Se molar ratio, the reaction time to the structure and optical properties of the obtained NCs were systematically investigated. ZnSe NCs were synthesized at 190 ^{0}C in 5–30 hours and the Zn:Se molar ratios of 0.75:1–1.5:1. The optical characteristics from absorption and photoluminescence spectra have been used to investigate the quality of the synthesized NCs, showing clearly that the highest quality ZnSe NCs were obtained at the reaction temperature of 190 ^{0}C for 20 hours with the Zn:Se molar ratio of 1:1. XRD and HR-TEM results show that the wurtzite structure and sphere ZnSe is obtained.

P6-NM

Preparation and magnetic properties of cylindrical permalloy nanowires

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The $Ni_{80}Fe_{20}$ (Py) nanowires has great application prospect in the field of spintronic functional devices based magnetic domain wall motion [1]. Recently, it is found that the magnetic domain wall speed in cylindrical wires can reach thousands of meters per second or more [2], which is beneficial to the realization of ultra-fast domain wall devices. Therefore, preparation of a high quality soft ferromagnetic nanowire is a necessity to realize the spintronic application [3]. However, in various preparation technologies, there is no one that can meet industrial production requirements currently.

In this work, a preparation technique and mechanism of cylindrical Py nanowires by electrodeposition based on porous anodic alumina (AAO) template are investigated with variation of the temperature, the pH value of plating solution, and the current density. Successfully, we have fabricated a homogeneous, surface-smooth, and structure-dense crystallized Py nanowires.

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P7-NM

Functional integral method for a ferromagnetic honeycomb monolayer

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In this paper, I have studied the thermodynamic properties of a ferromagnetic honeycomb monolayer with Heisenberg model include single-ion anisotropy using the functional integral method. Nearest neighbor interactions between magnetic atoms and non-magnetic atoms and next nearest neighbor interactions between the magnetic atoms take important roles in the properties of the monolayer. Besides, the effects of edge of zigzag type are also studied. The model is applied for a new 2D monolayer Co_2S_2 with robust ferromagnetism [1].

Reference:

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P8-NM

Effect of ZnO on magnetic interaction of Fe_3O_4/ZnO core/shell nanocomposites

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Fe_3O_4/ZnO core/shell nanocomposites with molar ratio of Fe_3O_4:ZnO at 7:1, 5:1, 3:1 and 1:1 have been synthesized by using two-step co-precipitation method. Magnetic properties, morphology, valence states of iron, crystal structure and microstructure of the samples were investigated systematically by vibrating sample magnetometer (VSM), field emission scanning electron microscope (FESEM), Energy-dispersive X-ray spectroscopy (EDX), X-ray absorption near edge spectroscopy (XANES) and synchrotron X-ray diffraction (SXRD). The analysis results indicate the formation of core/shell structure in the samples. The samples exhibit superparamagnetic behavior at room temperature. It was found that blocking temperature as well as magnetic interaction of the core/shell samples strongly depends on the content of the ZnO shell. The magnetic properties are discussed based on cation distribution, particle size, oxidation state and surface effect.

P9-NM

Phase-Pure Brookite TiO_2 as a highly active photocatalyst for the Degradation of Pharmaceutical Pollutants

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Institute of Materials Science, Vietnam

Spherical-shaped brookite TiO2 nanoparticles, average size of ~10 nm, were prepared by hydrothermal method. Under the sunlight equivalent UV irradiation, this brookite acts as an efficient photocatalyst for the photodegradation of recalcitrant pharmaceuticals, e.g cinnamic acid, ibuprofen, and diatrizoic acid. The photocatalytic assay was conducted using a high pharmaceutical load and a low photocatalyst amount, corresponding to a fixed photocatalyst/pharmaceutical mass ratio of 4. The photodegradation of the pharmaceuticals was followed by a combination of UV/Vis absorption spectroscopic, total organic carbon (TOC), and electrospray ionisation time-of-flight mass (ESI-TOF-MS) measurements. Scavenger measurements were performed to confirm the importance of active species holes and superoxide radicals in the cleavage of aromatic ring.

P10-NM

Biometamaterial: A dark ultrathin copper film based on Pistia Stratiotes

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Vietnam Japan University – Vietnam National University

We report on a dark metamaterial of copper fabricated on a Pistia Stratiotes leaves that was used as a template using sputtering method. The intial nanostructure on the surface of Pistia Stratiotes leaves was clarified by Scaning Electron Microscope(SEM) images. The surface of copper coated leaves has deep black color. It is due to the low reflectivity(<3%) over entire visible spectral range. The reflectivity and scattering intensity of leaves coated different thickness of copper are also considered. The optical properties of copper coated leaves were compared with of copper thin films which are calculated by Transfer Matrix Method(TMM). It suggests that the low reflectivity of coated leaves is distributed by both intial absorption of copper and nanostructure of leaves surface.

P11-NM

Biometamaterials: black ultrathin copper film fabricated on purple bauhinia

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Vietnam Japan University – Vietnam National University

Metamaterials are artificial structures capable of interacting with electromagnetic radiation in a desired fashion. However, there are many living creatures featuring their own form of metamaterial structures with specific functionalities which change their color without pigment or give hydrophobicity or bust up bacteria. We report on a black metamaterial of copper fabricated and a purple bauhinia that used as a template. A thin gold-film coat was made on the leaves by sputtering in air at low pressure, using a sputtering system (SYSKEY). In spite of copper coating over nanostructure of the surface of the purple bauhinia, the surface displays black and light-absorption over the visible wavelengths and infrared wavelengths. The low reflectance less than 0.025 over the entire visible spectral range is due to the copper coating on the water cabbage and purple bauhinia. Therefore it can be application for blackbody or light absorber. The reflection spectra were recorded with a MCPD-3000 spectrometer (Otsuka Electronics) using a halogen lamp as a light source. The single comb-like nanostructure of purple bauhinia was revealed by magnified scanning electron microcopy (SEM) images. SEM observations were performed with an JSM-IT 100 (JEOL).

P12-NM

Effective Anisotropic Media for Plasmonic core-shell Au-Cu_2O Nanoparticles

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Au- Cu_2O core-shell nanostructures with shell thickness varied from 10 nm to 50 nm were synthesized by chemical reduction method. The morphology and size of the synthesized Au-Cu_2O core-shell nanoparticles were examined using the Transmission electron microscopy (TEM) images. TEM images showed the formation of Au-Cu_2O core-shell NPs, where 20 nm Au NPs were covered with 10-40 nm Cu_2O shell layers. The crystal structure of the synthesized samples was characterized by X-ray diffraction (XRD). Band gap energy of Cu_2O shell changes from 2.0 to 2.4 eV and the SPR (Surface Plasmon Resonance) peak of the Au nanocore undergoes a large red shift a hundred of nanometer as demonstrated by UV-Vis absorption spectra. Experimental data was fitted with two theoretical models: the classical Drude framework and effective medium theory. The results showed that experimental data fit better with effective medium theory. However, more work is on progress to clarify the relation between SPR peak position and shell thickness.

P13-NM

Synthesis and Characterizations of TiO_2:Mn_{2+} Nanoparticles

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Titanium dioxides (TiO_2) with various Mn^{2+}-doping concentration (from 0 to 12 mol%) were successfully synthesized by the sol–gel method using titanium tetrachloride($TiCl_4$), and manganese II chloride ($MnCl_2.4H_2O$) tetrahydrate as precursors. The phase and crystallinity of the synthesized materials were investigated by powder X- ray diffraction pattern (XRD) and Raman spectroscopy. Diffuse reflection spectra were taken to investigate the absorption characteristics of the synthesized samples. The results show that the anatase and rutile phases existed simultaneously in all the samples; the Mn^{2+} doping enhances anatase-rutile transformation. The Mn^{2+} contents did not affect the lattice of TiO_2 host, but affected positions of its Raman modes. The band gap of the TiO_2:Mn^{2+} decreases with the increase of doping concentration.

P14-NM

Detection of carbendazim by SERS technique with SiO_2 ordered structures and silver nanoparticles

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Determination of carbendazim residue is usually done by gas chromatography and liquid chromatography with high sensitivity, but require complex procedures with a variety of chemicals. Therefore, there is a great demand for the development of a simpler, faster and more effective method for the detection of carbendazim at low concentration. Recently, the determination of pesticide residues by Surface-enhanced Raman scattering (SERS) technique has shown many advantages, one of the important steps in this technique is to fabricate the SERS substrate. In this report, we present a method to produce active-SERS substrate based on SiO_2/Ag ordered structures. First, the SiO_2 nanospheres were created by Stober method and arranged into opal crystals. Next, silver nanoparticles were dispersed on them. Finally, we used these SERS substrate to detect carbendazim pesticide. So far, we have succeeded in detecting carbendazim in acetone solution with concentration of 0.1ppm. Characteristic Raman peaks of carbendazim at 628, 1006, 1228 and 1277 cm^{-1} are clearly observed.

P15-NM

Fabrication of SERS substrates base on porous Si nanostructures and metal nanoparticles and their application in detection of carbendazim

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Surface-enhanced Raman scattering (SERS) is a widely used technique to detect a variety of poisonous substances, especially harmful organic substances which could be used in food processing and preservation. One of those is carbendazim, which is a pesticide causing cancer but still illegally used in agriculture at many country. Currently, SERS substrates can be produced by many different methods. In this report, we present the initial results of the use of noble metal nanoparticles (PtNPs, AuNPs, AgNPs) as a sensor for rapid detection of carbendazim at trace levels using SERS effect. At first, Au nanoparticles with diameter of about 10-30 nm were deposited onto a silicon wafer by sputtering and heat processing. After that, we dipped the wafer in a mixed solution of H_2O_2 and HF, as a result, porous silicon structure was created. Ultimately, the porous silicon structure was coated with sputtered Pt, Au, Ag nanoparticles. The results indicated that SERS substrates based on porous silicon covered Ag nanoparticles exhibited highest efficient in the SERS effect. With the use of AgNPs we could detect carbendazim at concentrations as low as 0.1 ppm.

P16-NM

Photo-Dynamic Properties of CdSe/CdS Quantum Dots in Intra-Cellular Media

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CdSe/CdS quantum dots (QDs) were seeded into Jurkat cells using Polyethylene glycol (PEG-1500) at different treatment times. Fluorescence microscopy images show that some QDs stick to the surface of the cells while others appeared to be inside the cells. As it is difficult to ascertain whether the QDs are indeed inside the cells or just behind the cells, additional spectroscopic studies were performed. Photoluminescence spectra show that the fluorescence intensities of the CdSe/CdS QDs are different between samples at different treatment times. Interestingly, the fluorescence lifetimes are also different. This confirms the interaction between the CdSe/CdS QDs and the intra-cellular media and that the QDs were successfully seeded into the cells.

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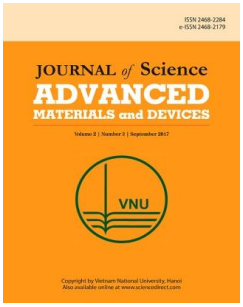
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