Egyptian Knowledge Bank
https://ijmti.journals.ekb.eg/

International Journal of
Materials Technology and Innovation

DOI: 10.21608/ijmti.2022.277912

IJMTI

Online ISSN 2682-4299

CMRDI
CENTRAL METALLURGICAL RESEARCH and DEVELOPMENT INSTITUTE

وزارة التعليم العالي والبحث العلمي

Workshop on

Development of Potentially Applied Advanced Functional Materials for A Better World

تطوير مواد وظيفية "أدائية" متقدمة لعالم أفضل

Pyramiza Hotel, Dokki, September 26th, 2022
Cairo, Egypt

ABSTRACT BOOK

Under the Auspices of

Prof. Dr. Mohamed Ayman Ashour
Minister of Higher Education & Scientific Research

Workshop Chairman

Prof. Dr. Emad Mohamed Ewais
President of CMRDI

Workshop Coordinator
Prof. Dr. Mohamed M. Rashad
Dean of Advanced Materials Institute, CMRDI

Head of Executive Committee
Prof. Dr. Osama A. Fouad
Head of Nanostructured Mater. and Nanotechnol. Dept., CMRDI

Organized by

Central Metallurgical Research and Development Institiute, CMRDI
P.O. Box: 87 Helwan 11421, Cairo, EGYPT

AMI

Featured Facilities

P R O G R A M

Workshop on

Development of Potentially Applied Advanced Functional Materials for A Better World
تطوير مواد وظيفية "أدائية" متقدمة لعالم أفضل

09:00-09:30	**Registration**
09:30-10:00	**Opening Session**
09:30-09:40	***Prof. Dr. Emad Ewais*** ***(President of CMRDI)*** **Welcome Speech & Overview on CMRDI**
09:40-09:50	***Prof. Dr. Mohamed Rashad*** ***(Dean of Advanced Materials Institute, CMRDI)*** **An Overview on Advanced Materials Institute @ CMRDI**
09:50-10:00	**Honoring of AMI Staff & Workshop Group Photo**
10:00-12:00	**Advanced Materials for Sustainability** **Chairpersons: Prof. Mahmoud Nasr & Prof. Atef Daoud**
10:00-10:30	***Prof. Iman El-Mahallawi, Prof. Mahmoud Tash (BUE, CU)*** **Future of Materials Engineering: Perspectives of Sustainability, Education & Research**
10:30-10:45	***Prof. Irene Samy Fahim (NU)*** ***Advancement of Materials to Sustainable and Green World***
10:45-11:00	***Dr. Mahmoud Rasly (CMRDI)*** ***Magnetic Devices for the Sustainable Development***
11:00-11:15	***Prof. Gamal Turky (NRC)*** ***Broadband Dielectric Spectroscopy: Advanced Materials for Double Layer Capacitance and Electrical Energy Storage***
11:15-11:30	***Dr. Eng. Fatma Fairouz (CMRDI)*** ***Reducing Carbon and Heat Emissions Using Light Weight High Performance Cylinder Liner***
11:30-11:50	***Prof. Abd El-hady B. Kashyout (SRTA-City)*** ***Strain Engineering and Sn Content Impacts on Nanomaterials of GeSn Heterostructures for Nanoelectronics and Photonic Devices***
11:50-12:00	**Sponsors Presentations**
12:00-12:30	**Coffee Break**

12:30-02:15	**Advanced Materials for Smart Applications** **Chairpersons: Prof. Yasser Ahmed & Prof. Ahmed Abd El-Moneim**
12:30-01:00	***Prof. Ibrahim M. El-Sherbiny (Zewail City)*** ***Nanomaterials-Based Smart Systems for Treatment of Cancer and Diabetes***
01:00-01:30	***Prof. Nageh Allam (AUC)*** ***Earth Abundant Nanostructured Materials for Energy Conversion and Storage***
01:30-01:45	***Prof. Mohamed El Tohamy (NRC)*** ***Mesoporous Silica Nanoparticles as a Theranostic Agent for Cancer Therapy***
01:45-02:00	***Dr. Hala Talaat Handal (NRC)*** ***Smart Materials, from Design Toward Applications***
02:00-02:15	***Dr. Amira El-Maddah (CMRDI)*** ***Towards Advanced Refractory and Ceramic Materials for Smart Applications***
02:15-03:15	**Lunch**
03:15-05:30	**Advanced Materials for Green and Electronic Applications** **Chairpersons: Prof. Malak Taher & Prof. Said El-Sheikh**
03:15-03:40	***Prof. Mohamed S. El-Deab (CU)*** ***Electrolytic Production of Hydrogen at NiCoFe-based Foam-like Ternary Catalysts***
03:40-04:05	***Prof. Ahmed Abd El-Moneim (E-JUST)*** ***Progress in Building 1st Green Integrated Solar Fuel Production System in Egypt Funded by ASRT***
04:05-04:30	***Prof. Badawi Anis (NRC & Zewail City)*** ***Optical and Electronic Properties of Single Chirality Semiconducting SWCNTs: a Step Towards Their Industrial Applications***
04:30-04:50	***Prof. Ahmad M. Mohammad (CU)*** ***Admitting Liquid Fuel Cells into Service: Enhanced Nanocatalysis of Formic Acid Electro–oxidation***
04:50-05:05	***Dr. Tamer Khedr (CMRDI)*** ***Emerging Designed-Nanostructured photocatalysts for Visible Light-Responsive Generation of Green "Solar" Fuel***
05:05-05:30	**Certificates - Recommendations - Closing**

WORKSHOP SESSIONS

SESSION I

09:30-10:00	Opening Session
09:30-09:40	***Prof. Dr. Emad Ewais*** ***(President of CMRDI)*** **Welcome Speech & Overview on CMRDI**
09:40-09:50	***Prof. Dr. Mohamed Rashad*** ***(Dean of Advanced Materials Institute, CMRDI)*** **An Overview on Advanced Materials Institute @ CMRDI**
09:50-10:00	**Honoring of AMI Staff & Workshop Group Photo**

Prof. Dr. Emad Ewais

President of CMRDI

Welcome Speech & Overview on CMRDI

Prof. Dr. Mohamed Rashad

Dean of Advanced Materials Institute, CMRDI

An Overview on Advanced Materials Institute @ CMRDI

SESSION II

10:00-12:00	Advanced Materials for Sustainability Chairpersons: Prof. Mahmoud Nasr & Prof. Atef Daoud
10:00-10:30	***Prof. Iman El-Mahallawi, Prof. Mahmoud Tash*** **Future of Materials Engineering: Perspectives of Sustainability, Education & Research**
10:30-10:45	***Prof. Irene Samy Fahim*** ***Advancement of Materials to Sustainable and Green World***
10:45-11:00	***Dr. Mahmoud Rasly*** ***Magnetic Devices for the Sustainable Development***
11:00-11:15	***Prof. Gamal Turky*** ***Broadband Dielectric Spectroscopy: Advanced Materials for Double Layer Capacitance and Electrical Energy Storage***
11:15-11:30	***Dr. Eng. Fatma Fairouz*** ***Reducing Carbon and Heat Emissions Using Light Weight High Performance Cylinder Liner***
11:30-11:50	***Prof. Abd El-hady B. Kashyout*** ***Strain Engineering and Sn Content Impacts on Nanomaterials of GeSn Heterostructures for Nanoelectronics and Photonic Devices***
11:50-12:00	**Sponsors Presentations**
12:00-12:30	**Coffee Break**

IMAN EL-MAHALLAWI

PROFESSOR

PROF. IMAN E L-MAHALLAWI

PROFESSOR OF MATERIALS AND METALLURGICAL ENGINEERING FORMER HEAD OF MINING, PETROLEUM AND METALLURGICAL ENGINEERING DEPARTMENT- FACULTY OF ENGINEERING- CAIRO UNIVERSITY 2014-2018. FOUNDING HEAD OF THE MECHANICAL ENGINEERING DEPARTMENT, THE BRITISH UNIVERSITY IN EGYPT 2006-2011 CURRENTLY, ADJUNCT PROFESSOR AT THE BRITISH UNIVERSITY IN EGYPT.

CONTACT

PHONE:

WEBSITE:
https://scholar.google.com/citations?hl=en&user=wCKZISkAAAAJ;
https://www.scopus.com/authid/detail.uri?authorId=6505895804

EMAIL:

Prof. Dr. Iman El-Mahallawi earned her first degree BSC in Engineering from Cairo University, July 1981, MSc from Cairo University in Dec. 1983, PhD degree from The University of Leeds in Jan 1987. Currently, Professor of Materials and Metallurgical Engineering at the Faculty of Engineering, Cairo University and an adjunct Professor at the Mechanical Engineering Department in the British University in Egypt (BUE). Founding Director of the Centre for Renewable Energy CRE at the British University in Egypt. Holding CEng and CSci titles, as well as being a Fellow Member of the IOM3 Royal Institute. H index number is 17 with (88 peer reviewed papers Scopus cited publications, and 113 Google cited publications). Attended and presented more than 60 research work in international and national conferences. Earned Cairo University Excellence Award 2014, and Distinguishment Award 2018. Full scholarship at Leeds University between Jan 1984 and Jan 1987 for PhD. Annual Publications Award Cairo university since 2010 till 2019. Award for best submission for innovation in teaching by Unit of Teaching and Learning Projects; Ministry of Higher education Egypt. Best supervised PhD Cairo University 2014 and 2016. Cairo University Research Excellence Award 2014 and Academic Excellence Award 2018.

Future of Materials Engineering: Perspectives of Sustainability, Education & Research

Prof. Iman El-Mahallawi, Prof. Mahmoud Tash

British University in Egypt & Metallurgical Engineering Department, Cairo University

Abstract

Materials science and metallurgical engineers have contributed significantly to the state of civilization achieved in this century. At this stage, we should all look at the future of metallurgy and material science engineers. A published survey on ASM online member community [https://connect.asminternational.org/discussion/future-of-materials-ngineering#bm8f083b51-79a9-4cce-9867-2be9aa82b159] has shown a wide range of views on the future of materials science and metallurgical engineering. The ideas ranged from supporting the significance of conventional metallurgical engineering to strongly disagreeing and supporting the significance and future of particular emphasis on semiconductor applications, medical device and renewables industry, etc..

This work presents the authors' vision in view of the long engagement with the topic, specially focusing on Perspectives of Sustainability, Education and Research. The study shows that metallurgical engineering will remain significant for developing countries as still very large amounts of industrial production of parts are made of metals (steel and aluminium), yet the expansion of materials engineering in developed countries leads to providing generalists to most of the topics meaning shortage in specialists in areas such as physical metallurgy, end product properties, welding, casting, industrial failure analysis, etc...Education should be inspired by local industrial needs, as well as global demands and what gets the attention from industry, financial support, equipment donations, etc. should be considered with priority. At least one generation more is to be involved in fault services, materials, welding, etc..

In addition to the conventional study areas and skills, the new areas for materials science and engineering should include, renewables, biomedical devices, energy harvesting and storage materials, materials for batteries, etc.. The next generation of engineers or scientists should be supported by professionals in developing skills and knowledge in materials for the energy industry, recovery of old materials, superconductors and failure prediction. There is also a need to develop new materials that include quantum physics concepts, thinking about the components for the new computers and AI that are emerging today. The expected changes in automotive industries to hybrid and electric vehicles means that aluminium industries need a boost in developing new processes and materials meeting the demands of high-tech applications.

Finally, the climatic changes and sustainability requirements mean that future materials and metallurgical engineers must find ways to recycle and/or dispose materials. A deep concern and consideration of those issues should be implemented in all curricula for future engineers. Standard specifications should be revised for elemental limits in view of recycling being the most adopted technology in the future for metal industries.

IRENE SAMY FAHIM

ASSOCIATE PROFESSOR

PROF. IRENE SAMY FAHIM

Director for Smart Engineering systems research center,
Nile University,
Cairo,
EGYPT

CONTACT

PHONE:

WEBSITE:

EMAIL:

Irene Samy Fahim is an associate Professor, Industrial and Service Engineering and Management department, Nile University Cairo, Egypt. She is the Director for Smart Engineering systems research center, Nile University. She won the state encouragement award for women 2020, and Hazem Ezzat Research excellence award, 2021 and Loreal UNESCO for Women in Science 2021 Egypt young talents program. She received a grant for Egypt Higher Education Climate change partnerships Grants in collaboration with Nottingham University and the British council. She also received a grant for capacity building for "Women in Science and Engineering" from IEEE Circuits and Systems Society. Dr. Fahim was selected in 2019 to be among the members of the first scientific council of the Egyptian Young Academy of Sciences (EYAS) as a part of the Academy of Scientific Research & Technology (ASRT) Dr. Fahim participated in Fulbright Junior Faculty program for renewable energy, 2016 and participated in Entrepreneurship and leadership Program, 1000Women, Goldman Sachs,2016. She got Newton Mosharfa institutional link award for two years in collaboration with Nottingham University, UK. for manufacturing plastic bags from natural materials where she got acknowledged by Mr. President Abdel Fattah El-Sisi for her work at the 3rd National Youth Conference in Ismailia, April 2017.

Advancement of Materials to Sustainable and Green World

Irene Samy Fahim

Director for Smart Engineering systems research center, Nile University, Cairo, EGYPT

Abstract

There is no universal definition of sustainable materials. These materials increase process efficiency, reduce pollution, and have a low impact on health and the environment. Because of environmental concerns, there is a growing demand for sustainable materials. These environmental impacts, however, can be mitigated with the help of advanced alternative materials. Furthermore, using advanced nanomaterials in lubricants/coolants will improve performance. Fabricating composites from end-of-life products/industrial waste is also a better way to reduce pollution. Most importantly, using green synthesis procedures for advanced material development rather than conventional synthesis that uses toxic chemicals is a promising solution for sustainability. As a result, developing lightweight materials, utilising green procedures, utilising waste materials, and effectively applying advanced materials in appropriate applications will promote sustainability.

MAHMOUD RASLY

Researcher

DR. MAHMOUD RASLY

Electronic and Magnetic Materials Department, Advanced Materials Institute, CMRDI, Cairo, Egypt
P.O. Box: 87 Helwan 11421, Cairo,
EGYPT.

CONTACT

PHONE:

WEBSITE:

EMAIL:

Dr. Mahmoud Rasly has obtained his B.Sc. (2007) & M.Sc. (2013) in Materials Physics, Physics Department, Ain Shams University, Cairo, Egypt. He performed his PhD in spin-based electronic devices at the Laboratory of Nanoscale Electron Devices, Electronics for Informatics Department, Hokkaido University, Hokkaido, Japan (2018). In 2019, he has joined the Magnetic Materials Group, National Institute for Materials Science (NIMS) in Japan, as a postdoctoral researcher. In 2021, he joined the Spintronics and Biosensor Group at INESC-MN (Microsystems and Nanotechnology) in Portugal as an associate researcher. He is currently assistant researcher of Electronics and Magnetic Materials, Advanced Materials Institute, Central Metallurgical Research & Development Institute, Cairo, Egypt. Dr. Rasly published +20 high-quality research articles in the physics of nanoscale devices and applications. He received the NIMS-Best Postdoctoral Research Award for 2020. He has +10 years of hand-on expertise in micro and nano fabrication of electronic devices and sensors in different clean rooms at Tohoku University, Hokkaido University, NIMS and INESC-MN. He is a research member in multiple of national research projects funded by CMRDI, ASRT, … and international industrial projects funded by the European commission, MagID, H2020.

Magnetic devices for the sustainable development

Mahmoud Rasly

Electronic and Magnetic Materials Department, Advanced Materials Institute, CMRDI, P.O. Box: 87 Helwan 11421, Cairo, Egypt

Abstract

Magnetic sensing technology is an essential technique in high-precision neural sensing, human interface, magnetocardiography, quantum computing and also electric vehicle control systems, in which sub-picoTesla (pT) magnetic-field detectivity is mandatory to promote high-quality healthcare devices and accelerate the change to smart societies.

Tunnel magnetoresistance (TMR) sensors consisting of CoFeB/MgO/CoFeB magnetic tunnel junction (MTJ) has attracted much interest in the detection of a wide range of magnetic fields from pT to mT, depending on the magnetic properties of TMR sensors and their designs. To improve the magnetic field sensing performance of those devices, the CoFeB sensing layer (SL) is often laminated with soft-magnetic materials such as NiFe [1]. Nevertheless, the lamination of NiFe above/below CoFeB tends to degrade the TMR ratio because the 111 texture of NiFe propagates to the CoFeB layer, interrupting the coherent spin-tunneling due to interfacial defects and lattice mismatch.

My talk includes (1) an introduction about the requirement of MTJ sensors, development techniques, noise in MTJ sensors & sensor evaluation parameters, (2) a discussion on our recent achievement in TMR sensor with CoFeBTa/Ta/CoFeB SL. I will clarify how we could overcome the texture propagation issue of NiFe by using CoFeBTa & optimize the annealing condition to get high TMR ratio and sensor sensitivity. Our single TMR sensor showed magnetic-field detectivity as low as 2.2 nT/Hz^0.5 at 10 Hz [2], and the bridge TMR sensor showed ~500 pT/Hz^0.5 at 10 Hz [3]. Further noise reduction is needed to reach sub-pT regime.

References:

[1] K. Fujiwara, M. Oogane et al, J. Appl. Phys. 111, 07C710 (2012).

[2] M. Rasly, T. Nakatani et al., J. Phys. D: Appl. Phys. 54, 095002 (2021).

[3] T. Nakatani, M. Rasly, et al, Intermag 2021 digest 26-30 April (2021): https://underline.io/lecture/16359--tunnel-magnetoresistance-sensors-with-cofebtaamorphous-soft-magnetic-sensing-layer

GAMAL TURKY

PROFESSOR

PROF. GAMAL TURKY

National Research Centre
Microwave Physics and
Dielectrics Department
Dokki, Giza,
EGYPT

CONTACT

PHONE:

WEBSITE:

EMAIL:

Professor Gamal Turkey has received his MSc in 1989 and PhD in 1994 in physics from Cairo University in cooperation with Mainz and Muenster universities, Germany. He is now and since 2004 Professor in Microwave Physics and Dielectrics Department (Head of the Dept. 2004-2018) @ National Research Centre, Cairo, Egypt. His research activity has been dedicated to the preparation and dielectric characterization of advanced materials for applications in electro-optics, energy storage and nanotechnology. In the period 2001-2004 he was a postdoc at the **Bundesanstalt für Materialforschung und prüfung (BAM), Unter Den Eichen 87, 12205 Berlin, Germany**, working on preparation and investigation of dielectric properties and related phenomena in polymer nanocomposites and novel photochromic materials. Also, in 2007 and 2009 @ **Institute of Experimental Physics I, University of Leipzig, Leipzig, Germany**, was working on Molecular dynamics in hyperbranched polymers. He is co-author of more than 100 papers in journals of Science Citation Index (SCI) and PI, Co-PI and member of many national and international research projects.

Broadband Dielectric Spectroscopy: Advanced materials for Double Layer Capacitance and Electrical Energy Storage

Gamal Turky

Professor of Physics, National Research Centre, Cairo, Egypt

Abstract

When EM radiation in the range 10–6 to 1012 Hz is applied to some molecular system, the direct response is the dielectric dispersion and absorption phenomena that occur in this vast frequency range due to (i) dipole relaxation arising from the reorientation-al motions of molecular dipoles and (ii) electrical conduction arising from the translational motions of electric charges (ions, electrons). This is the domain of Broadband Dielectric Spectroscopy (BDS). BDS became now one of the main techniques able to probe and evaluate the main molecular dynamics and charge carriers transport in modern and advanced materials research over about 15 decades of frequency. The intensive complex dielectric quantities of dielectric permittivity ε*(ω), electrical modulus M*(ω), electrical conductivity σ*(ω) and resistivity ρ*(ω) are immediately derivable on that extremely huge range of temperatures and frequencies. In condensed matter physics, the fluctuation is normally represented in terms of ε* and electric conduction behavior in terms of σ*, Z*, M* or ρ*. Usually the alternative representations of the dielectric properties of a material are the complex conductivity σ*(ω) or the complex electric modulus M*(ω) in condensed matter physics. They emphasize different aspects of polarization and charge transport in a material.

Electric double layer capacitors (EDLCs) store energy through the electrostatic interaction between electrodes and ions in the electrolyte. The formation of the interfacial layers is of essential importance for developing materials with a high capacity of energy storage, such as electrolytic capacitors and supercapacitors.

FATMA M. M. FAIROUZ

ASSCOIATE PROFESSOR

ASSOCI. PROF. FATMA M.M. FAIROUZ

Composite Department,
Advanced Materials Institute, Central Metallurgical R&D Institute,
CMRDI, P.O. Box 87 Helwan,
Cairo,
EGYPT.
TEL: (+202)27142011 – 27142454 – 27142452
FAX: 27142451

CONTACT

PHONE:
01092839919

WEBSITE:
https://scholar.google.com/citations?hl=en&user=wCKZISkAAAAJ;
https://www.scopus.com/authid/detail.uri?authorId=6505895804

EMAIL:
F5fairoz@yahoo.com

Dr. Eng. Fatma Mohamed Moheb Fairouz is associate professor at Composite Department, Advanced Materials Institute, Central Metallurgical R&D Institute, CMRDI, P.O. Box 87 Helwan, Cairo, Egypt. Ph.D in Metallurgical Engineering, Faculty of Engineering, Cairo University, December 2013. She has a great experience in melting and casting of a) aluminum and magnesium alloys and their composites using both flux and fluxless methods with gravity and squeeze casting, b) copper and zinc alloys and their composites, in addition of coin alloys.
She published about 30 articles in international journals and conferences in the field of composite materials and composite foams. She was a principal investigator and member in several research projects in the field of composite materials and composite foams. She acts as a reviewer for international journals.

Reducing Carbon and Heat Emissions Using Light Weight High Performance Cylinder Liner

Dr. Eng. Fatma Fairouz
Associate Professor at composite Department, Advanced Materials Institute, CMRDI
E-mail: f5fairoz@yahoo.com

Abstract

Improving fuel economy and reducing carbon and heat emissions are the greatest goal of automotive makers. Al-Si matrix composites provide the lightweight properties and significantly increase wear and corrosion resistance and reducing coefficient of thermal expansion. A359 alloy reinforced with hybrid of 10 vol.% Al_2O_3 (C1) or SiC (C2) and 5vol.% graphite has been successfully produced by stir casting technique prelude to use as cylinder liner instead of steel in order to reduce the engine weight and fuel consumption. Aging treatment was carried out for both produced hybrid composites specimens. The main microstructural features of the investigated hybrid composites were: the presence of α-Al as a primary phase, solid solution and eutectic mixture of Al and Si and good distribution of Al_2O_3 and SiC was observed. In addition, smearing and spreading of graphite on the reinforcement particles were detected. SEM micrographs and EDX analysis of hybrid composites were carried out. The presence of Mg, Al and O allows the formation of $MgAl_2O_4$ spinel as interface reaction, indicating a good contact between Al_2O_3 or SiC particles and Al-Si matrix. Coefficients of thermal expansion (CTE) was measured for the prepared hybrid composites and compared with those of commercial steel cylinder liner by using a dilatometer. The results indicate that A359 hybrid composites especially with addition of SiC (C2) may be favorable to use in applications at temperatures from 100 to 200˚C. Thermal fatigue test was carried out for both A359 hybrid composites and commercial steel cylinder liner for comparison. The crack propagation was examined by optical microscope after 70 cycles. There were no microscopic cracks in C1or C2 specimens. Also, there were no microscopic cracks along the interface between matrix and reinforcement that refers to good bonding between matrix and reinforcement in both C1 and C2. However, in case of commercial steel cylinder liner, large and deep cracks were observed. XRD was applied for hybrid composites and steel cylinder liner before and after thermal fatigue test. The results reveal that the calculated strain (ε) decreased after thermal fatigue test for composites, which means that no residual strain was stored in the matrix. The line breadth of C1 and C2 decreased after exposure to thermal cycles, which proofs loss of microstrains that might be in the crystallite, while steel cylinder liner exhibited a significant increase in line breadth after thermal cycles as a result of microstrains that formed as residual strains. The wear test was carried out under a load of 20N, sliding speed of 3 and 5m/s and sliding distance of 5400 and 9000 m for hybrid composites C1, C2 and steel cylinder liner. The hybrid composites exhibited better wear resistance and lower coefficient of friction compared with commercial steel cylinder liner. The worn surface was examined by SEM, EDX and XRD thin film to analyze the mechanically mixed layer (MML). The worn surface of C1and C2 revealed ploughing and abrasive wear at 3m/s then it changed to smearing at 5 m/s. At the same time, the commercial steel cylinder liner exhibited plastic deformation and delamination at the used test speeds.

ABD EL-HADY B. KASHYOUT

PROFESSOR

PROF. Abd El-Hady B. Kashyout

Electronic Materials Research Department, City of Scientific Research and Technological Applications (SRTA-City);
Alexandria,
Egypt;

Contact

PHONE:
+201006879733

WEBSITE:
www.srtcity.sci.eg

EMAIL:
akashyout@srtacity.sci.eg

Prof. Abd El-Hady Kashyout received his B.Sc. from Alexandria University, Egypt in 1989 in Electrical Engineering. He received his M.Sc. from Cairo University and Ph.D. from Alexandria University, in 1998 and 2001, respectively in the field of thin film solar cells. He was the Dean of Advanced Technology and New Materials Research Institute, (SRTA-City) from 2008 to 2011. He was the CEO of Investment Zone, (SRTA-City) and the Vice Director of SRTA-City for Engineering Affairs, where he was leading and managing the related affairs since 2011-2017 and 2013-2015 respectively. He is a professor of nano-electronic materials with a great experience in the preparation and characterization of nanomaterials, thin films for the applications of solar cells, gas sensors, fuel cells, smart materials and porous silicon as well as knowledge based economy development and management. He published more than 100 articles in international journals and conferences, supervised about 70 M.Sc. and Ph.D. students and worked in many national and international projects. He attended and participated in many workshops and training courses in Korea, China since 2008 concerning the science and technology parks management (STP's), UNESCO-WTA training workshops (2008, 2010, 2011, 2012) and SME's development (2013) . He got a big experience in science and technology management since 2001. He is leading a centre of excellence in the field of future and advanced studies, which develops related studies in knowledge-based economy, smart cities and renewable energies.

Strain engineering and Sn content impacts on nanomaterials of GeSn heterostructures for nanoelectronics and photonic devices

Abd El-hady B. Kashyout[2]*
Mohamed A. Nawwar[1], Magdy S. Abo Ghazala[1], Lobna M. Sharaf El-Deen[1], and

[1]Physics Department, Faculty of Science, Menoufia University, Shebin El-Koom, Menoufia, Egypt.
[2]Electronic Materials Department, Advanced Technology and New Materials Research Institute, City of Scientific Research and Technological Applications (SRTA-City), New Borg El-Arab City, Alexandria, Egypt.
***akashyout@srtacity.sci.eg**

Abstract

Heterostructures based on GeSn nano compound have high impacts in the integrated photonics devices. The promising feature of GeSn nanostructures is its direct band gap transition that is a result of Sn incorporation in Ge networks forming the strained structure. Here, we demonstrate a deep survey of the strain controlling mechanisms in GeSn nanomaterials with different methodologies. Using either layers configurations, Sn incorporation or by external stressors controls the emission of different photonic and nanoelectronic applications. We find that strain engineering arts modulate the bandgap of GeSn active media to control the region of emission for light emitting diodes, lasing applications, and spectral response for photodetection applications within the Mid IR region of the spectra and enhance the performance of MOSFETs. This gives GeSn nano compounds the chance to have large contribution in IoT physical devices and competes to the perovskite unstable materials since GeSn materials can achieve a stable and more reliable performance.

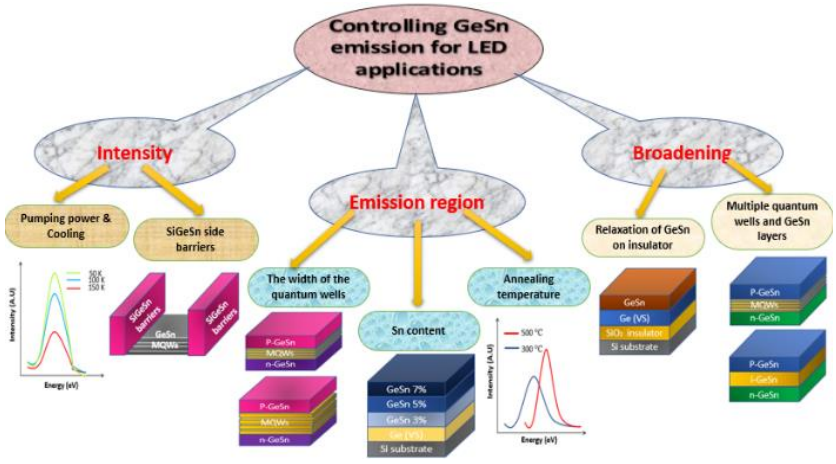

Figure 1. Controlling emission properties GeSn compound with different heterostructure configurations for LED applications.

SESSION III

12:30-02:15	Advanced Materials for Smart Applications Chairpersons: Prof. Yasser Ahmed & Prof. Ahmed Abd El-Moneim
12:30-01:00	***Prof. Ibrahim M. El-Sherbiny*** ***Nanomaterials-Based Smart Systems for Treatment of Cancer and Diabetes***
01:00-01:30	***Prof. Nageh Allam*** ***Earth Abundant Nanostructured Materials for Energy Conversion and Storage***
01:30-01:45	***Prof. Mohamed El Tohamy*** ***Mesoporous Silica Nanoparticles as a Theranostic Agent for Cancer Therapy***
01:45-02:00	***Dr. Hala Talaat Handal*** ***Smart Materials, from Design Toward Applications***
02:00-02:15	***Dr. Amira El-Maddah*** ***Towards Advanced Refractory and Ceramic Materials for Smart Applications***
02:15-03:15	**Lunch**

IBRAHIM M. EL-SHERBINY

PROFESSOR

Prof. Ibrahim M. El-Sherbiny
Founding Chairman of Nanoscience Program, Director of the Center of Materials Science, Zewail City of Science and Technology,
6th October City,
12578 Giza,
EGYPT

CONTACT

PHONE:

WEBSITE:

EMAIL:
ielsherbiny@zewailcity.edu.eg

Dr. Ibrahim M. El-Sherbiny is a Tenured Professor of smart nanomaterials and nanomedicine, and he is the Founding Chairman of Nano and Materials Sciences Programs, and the Director of the Center of Materials Science (CMS) at Zewail City of Science and Technology. El-Sherbiny earned his Bachelor degree, with honors (top scholar) and his Master of Science from Mansoura University, and his PhD in Smart drug delivery from Massey University, New Zealand in 2007. From 2008 to 2009, El-Sherbiny has joined various pharmaceuticals research groups as a post-doctoral fellow at the College of Pharmacy, University of New Mexico and Texas University-Austin in the United States. Then, he has been apointed as Research Assistant Professor of pharmaceutics, College of Pharmacy, at the University of Texas-Austin, USA starting from 2010.

▪ El-Sherbiny's academic acumen was recognized by being offered a Fulbright Fellowship at the School of Biomedical Engineering, University of Michigan (U.S.) in 2009. Besides, Dr. El-Sherbiny has received several honoring and local, Arab and international scientific awards, including, for instance, the Order of the Egyptian Republic in Science and Arts of the first class and an honor from the President El-Sisi. El-Sherbiny also won the prestigious Khalifa Educational Award being the distiguished University Professor at the Arab world level, the State Award for Excellence in Advanced Technological Sciences for the year 2018 due to the excellence of his research in the field.

Nanomaterials-Based Smart Systems for Treatment of Cancer and Diabetes

Ibrahim M. El-Sherbiny

Professor of Smart Nanomaterials & Nanomedicine, Founding Chairman of Nanoscience Program, Director of the Center of Materials Science, Zewail City of Science and Technology, 6th October City, 12578 Giza, Egypt

Email: : ielsherbiny@zewailcity.edu.eg

Abstract

Smart nanomaterials represent a very favorable class of materials that are able to dramatically change their properties in response to specific environmental stimuli such as pH, temperature, magnetic field, light, electricity, certain chemicals, etc. More recently, the ability to manage the size in the nanoscale, shape, porosity and surface morphology of materials has created new opportunities to evade various challenges in various applications. Besides, the concurrent fast and considerable stimuli-response of these nano-structured smart nanomaterials may magnify the scope of their applications, and suggest improved performance in their uses especially in the biomedical fields. The talk will give an overview of nanotechnology and smart nanomaterials, and will describe the development, *in-vitro* and *in-vivo* evaluation of several new series of smart nano and nano-in-micro systems for diagnosis and treatments of different types of cancer and diabetes.

NAGEH ALLAM

PROFESSOR

PROF. NAGEH ALLAM

Professor of Materials Science and Engineering
Director, Energy Materials Laboratory (EML)
School of Sciences and Engineering (SSE)
The American University in Cairo,
EGYPT

CONTACT

PHONE:
(+2-02) 2615-2568

WEBSITE:
http://www.aucegypt.edu

EMAIL:
nageh.allam@aucegypt.edu

Professor Nageh Allam received his PhD in materials science and engineering from Pennsylvania State University and pursued his postdoctoral studies at both Georgia Institute of Technology and Massachusetts Institute of Technology (MIT). After his postdoctoral tenure at GaTech and MIT, He joined the faculty at The American University in Cairo (AUC), where he is currently a tenured Professor of materials science and engineering and the Director of the Nanotechnology graduate program. He is the founder of the AUC Energy Materials Laboratory (EML) and the co-founder of the Solar Energy program. Allam's research is multidisciplinary in nature as it is at the interface between nanoscience, physics, and chemistry. It deals with the development of a set of synthetic and fabrication techniques to obtain well-designed nanostructured materials with composition, size, and shape control for use in energy conversion and storage, water desalination, sensors, electronic waste recycling, biofuel, biofertilizers, biomedical applications, among others. The research comprises both experimental and theoretical activities. He has published more than 270 papers in reputed peer-reviewed international journals and has authored more than 160 conference articles. He is the recipient of the Ford Foundation international graduate fellowship, RAK-CAM postdoctoral fellowship, the World Academy of Sciences (TWAS) Yong Scientist Award.

Earth abundant nanostructured materials for energy conversion and storage

Nageh Allam

Dr. Nageh Allam received the Abdel-Hamid Showman Foundation Award in Applied Sciences, the State of Egypt Encouragement Award in Advanced Technological Sciences, the State of Egypt Excellence Award in Advanced Technological Sciences, the AUC Excellence in Research and Creative Endeavors Award, and the recipient of the 2020 International Association of Advanced Materials (IAAM) Scientist Medal Award. Allam has been recognized as one of the top 2% impactful Scientists in the recent Stanford University Report (Elsevier 2020 and 2021). He has been recently elected a fellow of the African Academy of Sciences (2022). Also, Dr. Allam is the 2022 recipient of the Obada international prize in Advanced Technological Sciences.

MOHAMED ELTOHAMY

PROFESSOR

PROF. MOHAMED ELTOHAMY

National Research Centre
Glass Research Department
Dokki, Cairo 12622,
EGYPT

CONTACT

PHONE:
+201116620442

WEBSITE:

EMAIL:
mtohamy9@gmail.com

Professor Mohamed ElTohamy is a research professor at Glass Research Department, National research Centre, Dokki, Cairo, Egypt. Prof. ElTohamy has received his bachelor degree in science in 1990 from Faculty of Science, Cairo University. After that he got his master degree in Chemistry from Cairo University in 1996 then his PhD degree in Material Chemistry in 2001 from Ain Shams University, Cairo, Egypt. He did his postdoctoral research at Dankook University, South Korea and worked there from Aug 2011 to Aug 2017.

His research interest is focusing on Designing of silica-based carrier prototypes (nano to micro) for therapeutic molecule delivery, surface modifications for fabrication of stimuli-responsive hydrogels biomaterials and development of mucoadhesive material for cancer modeling.

He is the PI and members of several national and international projects. Up to the present, he has published over 40 papers.

Mesoporous Silica Nanoparticles as a Theranostic Agent for Cancer Therapy

Mohamed El Tohamy
Glass Research Department, National Research Centre, Cairo, Egypt

Abstract

Nanoparticles have become a powerful tool in oncology not only as carrier of the highly toxic chemotherapeutic drugs but also as imaging contrast agents that provide valuable information about the state of the disease and its progression. The enhanced permeation and retention effect for loaded nanocarriers in tumors allow substantial improvement of selectivity and safety of anticancer nanomedicines. Additionally, the possibility to design stimuli-responsive nanocarriers able to release their payload in response to specific stimuli provide an excellent control on the administered dosage. The aim of this Lecture is not to present a comprehensive revision of the different theranostic mesoporous silica nanoparticles (MSN) which have been published in the recent years but just to describe a few selected examples to offer a panoramic view to the audience about the suitability and effectiveness of these nanocarriers in the oncology field.

HALA TALAAT HANDAL

RESEARCHER

DR. HALA T. HANDAL

National Research Centre
Inorganic Chemistry Department
Dokki, Giza,
EGYPT

CONTACT

PHONE:

WEBSITE:

EMAIL:

Dr. Hala Talaat Handal is a doctor researcher in Inorganic Chemistry Department, National research Centre, Dokki, Cairo, Egypt. Dr. Handal had received her bachelor degree in science in 2004 from faculty of Science, Cairo University. After that She got her master degree in chemistry from Cairo University in 2009 then her PhD degree in chemistry in 2015 from University of Calgary, Canada. She did her postdoctoral research at Laboratory of Subatomic Physics & Cosmology (LPSC), Grenoble, France in 2021.

Her research interest is focusing on the strategic design and implementation of functional materials in different applications that include: fuel cell, electrochromic and photochromic devices, smart windows, solar water splitting, supercapacitors, spintronics, drug delivery.

She is the PI and members of several national and international projects. Up to the present, she has published 19 papers.

Smart materials, from design toward applications

Hala Talaat Handal

Inorganic Chemistry Department, National research Centre, Dokki, Cairo, Egypt

Abstract

The overpopulation and modern life are leading to an excessive consumption of the fossil fuel and fast degradation of the natural ecosystem. As a consequence, a falling in the global energy yield from the natural resources, besides a shortage of fresh water take place. Searching for integrative approaches becomes a must to achieve a substantial growth in the renewable energy besides wastewater treatment to realize water-energy and food sustainability. The nexus of sustainable development and new technologies is materials therefore tailoring functional materials and investigate their properties acquired a prominent position in numerous high-tech areas. This talk aims at presenting the outcomes of some of the case studies that disclose the influence of material design and synthesis conditions on their functionality in photocatalysis, energy production and storage devices, smart windows, spintronics, and drug delivery systems.

AMIRA EL-MADDAH

Researcher Assistant

DR. AMIRA EL -MADDAH

Central Metallurgical Research & Development Institute, CMRDI
Ceramics and Refractory Materials Department
P.O. Box: 87 Helwan
Cairo,
EGYPT

CONTACT

PHONE:
+201024319240

WEBSITE:
www.cmrdi.sci.eg

EMAIL:
amiraelmadah@gmail.com

Amira El-Maddah is a chemical engineer working as a researcher assistant at Central metallurgical research and development institute, refractories and ceramics department. Holding a master's degree in chemical engineering from Cairo University. Worked as a mathematics teaching assistant at the higher institute of engineering and technology in New Damietta.
Her research interest focuses on refractories materials and their implementation in solar receivers, piezoelectric and thermoelectric material
She is a member of several national projects. Up to the present, she has published 6 papers.

Towards Advanced Refractory and Ceramic Materials for Smart Applications

Amira El-Maddah

Central Metallurgical Research and Development Institute

Abstract

Refractory and ceramic materials are the type of materials that are involved in all aspects of our life. Basically, refractories are materials that can withstand high temperature, pressure, and chemical attack. Hence, they are involved in various applications such as dishes, dental supplies, building materials, electrical applications, and energy applications. In this regard, constant development and fabrication of refractories are vital procedures to improve the industrial sector and keep discovering new materials for energy and electrical applications. One of the most refractory materials that we are concerned with is refractory cement, which is a type of cement with high thermal stability. While traditional Portland cement-based concrete can be damaged or destroyed by high temperatures, refractory cement resists such damage. Portland cement consists primarily of calcium silicate, compared to refractory cement that uses monocalcium alumina ($CaAl_2O_4$)—made from a high-temperature blend of alumina (Al_2O_3) and calcium carbonate ($CaCO_3$)—among other additive compounds. For refractory cement, a high-quality aluminum oxide source is essential for optimum performance at high temperatures. Lower-grade aluminum-based cement can use more readily available aluminum sources such as bauxite - although their thermal performance characteristics are inferior. Much like regular cement, refractory cement can be fired in a brick shape, but is often molded into a specific shape.

SESSION IV

03:15-05:30	Advanced Materials for Green and Electronic Applications Chairpersons: Prof. Malak Taher & Prof. Said El-Sheikh
03:15-03:40	**Prof. Mohamed S. El-Deab** ***Electrolytic Production of Hydrogen at NiCoFe-based Foam-like Ternary Catalysts***
03:40-04:05	***Prof. Ahmed Abd El-Moneim*** ***Progress in Building 1st Green Integrated Solar Fuel Production System in Egypt Funded by ASRT***
04:05-04:30	***Prof. Badawi Anis*** ***Optical and Electronic Properties of Single Chirality Semiconducting SWCNTs: a Step Towards Their Industrial Applications***
04:30-04:50	***Prof. Ahmad M. Mohammad*** ***Admitting Liquid Fuel Cells into Service: Enhanced Nanocatalysis of Formic Acid Electro–oxidation***
04:50-05:05	***Dr. Tamer Khedr*** ***Emerging Designed-Nanostructured photocatalysts for Visible Light-Responsive Generation of Green "Solar" Fuel***
05:05-05:30	Certificates - Recommendations - Closing

MOHAMED SAADA EL-DEAB

PROFESSOR

PROF. MOHAMED SAADA EL-DEAB

Professor of Physical Chemistry
(Nanotechnology-Energy Conversion-Fuel Cells)
Chemistry Department,
Faculty of Science,
Cairo University,
Cairo, Egypt.

CONTACT

PHONE:
010-1214-5268

WEBSITE:

EMAIL:
msaada68@yahoo.com

Prof. El-Deab received his PhD from Cairo University (1999) and was promoted as a full Professor of Physical Chemistry- Cairo University on 2010. He received the prestigious JSPS post doc fellowship for two years (2001-2003), JSPS long-term invitation fellowship (2007) and the JSPS-Bridge fellowship (2015) in the Department of Electronic Chemistry - Tokyo Institute of Technology, Japan. In 2008, he has been awarded the prestigious Alexander von Humboldt (AvH) fellowship to Ulm University-Germany for 21 months. He is the author of more than120 international publications and contributed to 9 review chapters in textbooks which receives more than 3660 citations and h-index of 31. The major research topics include: Electrocatalysis by nanoparticles, energy conversion systems (FCs), waste water treatment, Biodiesel production.

Electrolytic production of hydrogen at NiCoFe-based foam-like ternary catalysts

Mohamed S. El-Deab*

Department of Chemistry, Faculty of Science, Cairo University, Cairo, Egypt
*** E-mail: msaada68@yahoo.com**

Abstract

The global concern about decarbonization concurrently with the growing world population and the unlimited needs for energy call for the development of renewable and sustainable energy production routes. In this context, hydrogen stands as a promising candidate. The massive production of hydrogen gas (for industrial applications, e.g., steel and fertilizers) depends markedly on fossil fuels via reforming processes (grey and blue hydrogen). However, promising green production technologies (with zero carbon emissions), relying on renewable sources, are being rapidly developed as efficient and economic alternatives. However, the efficiency of storage/conversion cycles is under extensive research to exploit the whole capacity and use electricity when needed. Herein, the development of metal/oxygenated metal porous interfaces based on NiCoFe ternary catalyst is introduced, leading to a prompt water dissociation step in alkaline HER. Morphological, structural as well as electrochemical characterization of the proposed cathodes are successfully carried out by several surface characterization techniques, e.g., SEM, XRD, EDS-mapping, XPS, …etc. The electrochemical measurements show that the proposed electrocatalyst exhibits a striking activity, with an overpotential of –50 mV while operating at 10 mA cm^{-2}, outperforming its precursors and surpassing/approaching the activity of the benchmark and precious-metals-fabricated catalyst.

Keywords: Green economy, Decarbonization, Regenerative fuel cells, Renewable energy

AHMED ABD EL-MONEIM

PROFESSOR

PROF. AHMED ABD EL-MONEIM

Dean and director of Graphene Center of Excellence,
Nanoscience program,
School of Basic and Applied Sciences,
Egypt-Japan University of Science and Technology.

CONTACT

PHONE:
0201281229082

WEBSITE:

EMAIL:
Ahmed.abdelmoneim@ejust.edu.eg

Prof. Ahmed Abd El-Moneim, received his B.Sc. and M.Sc. degrees from Faculty of Science, Cairo University in Egypt in 1988 and 1993, respectively. Received his PhD degree from Faculty of Engineering, Tohoku University, Japan, 1998. He received Post Doc and visiting fellowships from Japan, Germany, US and South Africa during the period between 1999 and 2019. Founding chair of Materials Science and Engineering Department. Dean of Basic and Applied Sciences Institute, Director of Graphene Center of Excellence for Energy and Electronic Applications

His research is currently focused on; i) synthesis, characterization and application of nanomaterials-based on graphene for liquid and hydrogen fuel production, ultra-supercapacitors, batteries, capacitive deionization, ii) fabrication of thermo-electric and, strain gauge and gas sensors; iii) corrosion and thermal management of metallic structures.

He has 3 US, 1 JP and 2Egy patents, 130 International per-reviewed journal and conference proceedings. Supervising/supervised 42 M.Sc and Ph.D. students. PI of 3 grants from the industry, 6 research grants from the STDF in collaboration with USA, Japan and EU.

Progress in building 1st Green Integrated Solar Fuel Production System in Egypt Funded by ASRT

Ahmed Abd El-Moneim

Egypt-Japan University of Science and Technology

Abstract

This project aims to build up a green Liquid fuel production system based on the conversion of CO_2Emissions to Liquids (ETL). The proposed ETL technology uses CO_2 as carbon feedstock and hydrogen from green desalinated seawater electrolysis powered by renewable energy source units (Concentrated Solar Power (CSP) and/or Photovoltaic (PV)) and converts them into long chain hydrocarbon liquid fuels and oxygen as the only by-product. The system includes units from custom made CSP/MEP, PEM electrolyser, RWGS Unit, and FT reactor. The system operation will concentrate on using RWGS/CO-FT and CO_2-FT synthesis process in enhancing the indirect and direct hydrogenation of CO_2 to liquid fuel.

The project gathers a consortium of experts who have national and international academic and industrial experience with the proposed system's hardware installation, operation, upgrade and integration. This experience is in water desalination, green hydrogen production from water electrolysis, liquids fuel production and FT synthesis. The proposed system will provide an innovative solution for a lower carbon footprint and industrial CO_2 emissions in Egypt.

BADAWI ANIS

ASSOCIATE PROFESSOR

ASSOC. PROF. BADAWI ANIS

National Research Centre &
Adjunct professor at Zewail City of Science and Technology

Spectroscopy Department
Dokki, Giza,
EGYPT

CONTACT

PHONE:

WEBSITE:

EMAIL:

Associate Professor Badawi Anis received the B.Sc. and M.Sc. degrees in physics from Cairo University, Fayoum campus, in 1999 and 2005, respectively, and the Ph.D. degree in spectroscopy of carbon nanomaterials under extreme conditions from Augsburg University, Germany, in 2013. He was a postdoctoral associate (2013-2014) with the University of Augsburg. He is currently an associate professor of spectroscopy with the National Research Centre (NRC), Cairo and adjunct professor at Zewail city of science and technology. His is leading research on terahertz and Raman spectroscopy of carbon nanomaterials, single-chirality nanotubes, and Laser-induced graphene. His research interests expand into using carbon nanomaterials in different areas including, sensors, energy storage materials, and water purification.

He has participated in establishing the Molecular and Fluorescence Lab., at NRC, securing funds, installation of several high-end instruments such as time resolved PL, XPS, Raman and FTIR microscopes, CVD, and AFM. He has been organizing and conducting training workshops on spectroscopy of nanomaterials synthesis and applications.

Optical and electronic properties of single chirality semiconducting SWCNTs: a step towards their industrial applications

Badawi Anis

Spectroscopy Department, Physics Research Institute, National Research Centre, 33 El Bohouth St., 12622, Dokki, Giza, Egypt

Abstract

Towards more realistic and practical implementation of SWCNTs in recent electronic devices and applications, their optical and electronic properties must be tailored and fine-tuned by doping or filling.

However, the presence of multi-chiralities SWCNTs hinders the unambiguous understanding of the interaction and the influence of dopants on the optical and electronic properties of a specific type of nanotubes. Great achievements have been taken in separation and preparation of specific chirality of SWCNTs, so called single chirality nanotubes. In general, each single chirality carbon nanotube has a unique optical and electronic properties. Separation of s-SWCNTs with a specific diameter and band gap from a mixture of multi-chiralities and diameters facilitates the understanding of the of interaction mechanism between single chirality s-SWCNTs and dopants.

We present transmission measurements on chirality enriched semiconducting (12,1) and (13,2) single-walled carbon nanotubes (CE-s-SWCNTs) and CE-s-SWCNTs doped with iodine (I2@CE-s-SWCNTs) and bromine (Br2@CE-s-SWCNTs) in wide frequency range from 0.1 - 40 THz. Using terahertz time-domain spectroscopy (THz-TDS), We show a quantitative study on redistribution of charge carriers between the inner I2 and Br2 molecules and CE-s-SWCNTs walls and its effect on the electronic states close to the Fermi energy. The Drude term, carriers relaxation time, scattering rate, and σ_{DC} were obtained by fitting $\sigma_{real}(\omega)$ curves using Drude-Lorentz model.

PROF. AHMED ALAKRAA

Cairo University
Chemistry Department
Cairo,
EGYPT

CONTACT

PHONE:

WEBSITE:

EMAIL:
ammohammad@cu.edu.eg

AHMAD M. M. ALAKRAA

PROFESSOR

Prof. Ahmad Mahmoud Mohammad Alakraa received his B.Sc. in 1995 from Cairo University (Chemistry major) where he was ranked the third in a class of ~ 400 students. He was appointed in the same year as a TA in the Chemistry Department at Cairo University. He was awarded his M.Sc. (Surface Chemistry-Physical Chemistry) from Cairo University in 1999. His thesis dealt with the development of a simple "*in-situ*" electrical conductivity-based technique to address the adsorption/desorption of some oxidizing and reducing gases on some transition metal oxides of potential applications in the catalytic converters of automobiles. From the same institution and in 2004, he received his PhD (Nanotechnology-Physical Chemistry). During this course and in 2001, he joined the Pennsylvania State University as an RA for two years where he conducted the experimental work of his PhD. He succeeded to develop a novel procedure to fabricate metallic/Si nanowire contacts where the contact's interface grew along the cross sectional of the nanowire. In 2005, he received a Post Doc. fellowship for two years from Tokyo Institute of Technology in collaboration with Sanyo Electric Co., Ltd. In this program, he developed efficient titanium and tantalum oxide dimensionally stable anodes for the ozone electro-generation. He worked (in a sabbatical leave) for the British University in Egypt (Associate Professor - Department of Chemical Engineering) from 2011-2015, the American University in Cairo (Adjunct Professor - Department of Physics) in Spring 2019 and the Higher Technological Institute (Adjunct Professor) from Fall 2019 to Summer 2020.

Admitting Liquid Fuel Cells into Service: Enhanced Nanocatalysis of Formic Acid Electro–oxidation

Ahmad M. Mohammad†[1],

Bilquis A. Al-Qodami[1], Heba H. Farrag[1], Ahmed S. Abd-Elstar[1], Hafsa H. Alalawy[1], Sayed Y. Sayed[1], Nageh K. Allam[2], Islam M. Al-Akraa[3]

[1] Chemistry Department, Faculty of Science, Cairo University, Cairo 12613, Egypt
[2] Energy Materials Laboratory, School of Sciences and Engineering, The American University in Cairo, New Cairo 11835, Egypt
[3] Department of Chemical Engineering, Faculty of Engineering, British University in Egypt, Cairo
† E-mail: ammohammad@cu.edu.eg

Abstract

The development of efficient and stable iron-based nanostructured anodes for the formic acid electro–oxidation (FAO); the principal anodic reaction in the direct formic acid fuel cells (DFAFCs), is sought. The motivation of this work was inspired from the promising future of DFAFCs as a potential alternative to the traditional hydrogen fuel cells (HFCs) in harvesting clean electricity for several portable and stationary applications. While HFCs experienced troubles with the H_2 use, storage and transportation, the DFAFCs enabled the direct use of liquid fuels without a reformer and offered the potential for enhanced cell performance by lowering the fuel crossover. Nevertheless, the catalytic activity of the platinum catalysts that are typically employed for FAO deteriorates rapidly due to the accumulation of a poisoning CO intermediate. The modification of Pt and Pd anodes with iron/iron oxide nanostructures succeeded to mitigate this poisoning and to further participate in the reaction mechanism in the way facilitating the charge transfer; boosting, ultimately, the kinetics of FAO. The deposition of the iron modifier took place electrochemically with a post-activating step that identified the catalyst's activity and durability. The catalytic enhancement of FAO was analyzed in view of the *state-of-the-art* characterization tools and the results were promising to sustain a future prosperity.

Keywords: Formic acid, Iron catalysts, Electro–oxidation, Poisoning, Fuel cells

TAMER M. KHEDR

Researcher A.

PROF. TAMER KHEDR

Nanostructured Materials & Nanotechnology Department, Advanced Materials Institute, Central Metallurgical Research & Development Institute (CMRDI), P.O. Box: 87 Helwan 11421, Cairo, EGYPT.

CONTACT

PHONE:
+2-01007639546

WEBSITE:
https://orcid.org/0000-0002-6605-017X
https://scholar.google.com/citations?hl=en&user=VtozjJ0AAAAJ&view_op=list_works&sortby=pubdate
https://www.scopus.com/authid/detail.uri?authorId=57189045118
https://ewakowalskasapporo.wixsite.com/ewa-kowalska

EMAIL:
tamerkhedr56@gmail.com;
khedr.t@cat.hokudai.ac.jp

Dr. Tamer M. Khedr is Researcher A. in Nanostructured Materials & Nanotechnology Department, Advanced Materials Institute, Central Metallurgical Research & Development Institute (CMRDI), Helwan, Cairo, Egypt. He received his Ph.D. degree in Chemistry (2022), Ain Shams University, Cairo, Egypt with a Joint Supervision Scholarship, Hokkaido University, Sapporo, Hokkaido, Japan, Two years). Khedr carried out Doctoral Research at Photocatalysis and Nanotechnology Unit, Institute for Technical Chemistry, Hannover University, Germany (2017, SUPV. Prof. Detlef W. Bahnemann), and Photocatalysis Department, Institute for Catalysis, Hokkaido University, Hokkaido, Japan (2018-2020, SUPV. Prof. Bunsho Ohtani and Prof. Ewa Kowalska). Khedr carried out Master Research at Photocatalysis and Nanotechnology Unit, Institute for Technical Chemistry, Hannover University, Germany (2014, SUPV. Prof. Detlef W. Bahnemann). His research interests are mainly in the area of photocatalysis, including synthesis, characterization of novel nanostructured photocatalysts, and environmental and energy photocatalysis.

Emerging Designed-Nanostructured photocatalysts for visible Light-Responsive Generation of Green "Solar" Fuel

Tamer Khedr

Nanostructured Materials & Nanotechnology Department, Advanced Materials Institute, Central Metallurgical Research & Development Institute (CMRDI), Helwan, Cairo, Egypt

Abstract

Developing eco-friendly strategies to produce green fuel has attracted continuous and extensive attention. Visible-light-responsive (VLR) photocatalysis has been proposed as a promising method for H_2-fuel generation. Here, a novel 2D/2D porous S-doped g-C_3N_4/Bi_2WO_6 S-scheme heterostructure photocatalyst has been prepared by a facile one-pot solvothermal method. The physicochemical properties of the obtained photocatalysts were analyzed by XRD, FE-SEM, STEM, TEM, HR-TEM, specific surface area (BET) measurement, UV-vis DRS, XPS, PL, and reversed double-beam photo-acoustic spectroscopy (RDB-PAS). The prepared photocatalysts were applied for photocatalytic H_2 evolution, overall water splitting, and simultaneous degradation of organic pollutants and H_2 evolution under vis irradiation. The condition-dependent activity was probed to achieve the best photocatalytic performance. It was demonstrated that emerging design of S-scheme heterojunction played a crucial role to boost the photocatalytic activity of both bare g-C_3N_4 and pristine Bi_2WO_6 materials. It has been found that though all properties are crucial for the overall photocatalytic performance, an efficient spatial charge carriers' separation and high light absorption ability are probably key factors of high photocatalytic activity. Moreover, the photocatalysts exhibit significant stability during recycling. Accordingly, a significant potential of prepared S-scheme photocatalyst has been revealed for the practical use under natural solar radiation.

ORGANIZING COMMITTEE

Prof. Emad Ewais	A. Prof. Fatma Faioruz	Dr. Dina Besisa	Mr. Ali Nazeir
Prof. Mohamed Rashad	A. Prof. Ahmed Mortada	Dr. Yosra Mohamed	Mr. Abdullah Ahmed
Prof. Osama Fouad	Dr. Essam Ahmed	Ms. Amina Ibrahim	

AMI Featured Facilities