conferenceseries.com

21st International Conference on

Advanced Materials & Nanotechnology

September 04-06, 2018 | Zürich, Switzerland

Keynote Forum

Day 1

Dieter M Gruen, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-019

Dieter M Gruen

Dimerond Technologies, USA

Hybrid conversion solar system (HYCSOS)

With increasing energy and environment concerns, how to efficiently convert and store energy has become a critical topic. Electrochemical energy storage devices, such as supercapacitors and batteries, have been proven to be the most effective energy conversion and storage technologies for practical application. Supercapacitors and lithium-based batteries are particularly promising because of their excellent power density and energy density. However, further development of these energy storage devices is hindered by their poor electrode performance. The carbon materials in supercapacitors and batteries, such as graphite, activated carbons and various nanostructured carbon materials (ordered porous carbon, CNT, graphene etc.), are often derived from nonrenewable resources under relatively harsh environments. Naturally abundant biomass with hierarchically porous architecture is a green, alternative carbon source with many desired properties for supercapacitors and lithium-based batteries. Recently, we converted cotton, banana peel, and recycled paper into highly porous, conductive activated carbon scaffolds for advanced energy storage applications via a low-cost and high throughput manufacturing process. The activated carbon scaffolds were further coated with active materials such as $NiCo_2O_4$, NiO, Co-Al layered double hydroxides (Co-Al LDHs), Ni_2S, sulfur nanoparticles, and graphene to enhance their electrochemical properties. The biomass-derived activated carbon materials are effective in improving supercapacitor's energy density and in blocking the dissolution of reaction intermediates in lithium sulfur batteries. Especially, the biomass-derived carbons provide scaffolds for hosting sulfur in lithium sulfur batteries to manipulate the "shuttle effects" of polysulfides and improve the utilization of sulfur. In particular, the activated carbon textiles (derived from cotton textiles) are flexible and conductive, and an ideal substrate for constructing flexible supercapacitors, batteries, and self-powered flexible solar cell/supercapacitor (or battery) systems. Using biomasses is definitely the right track towards making renewable carbon materials for future energy storage devices.

Recent Publications

1. Mareš J J, Hubík P, Krištofik J, Kindl D, Fanta M, Nesládek M, Williams O and Gruen D M (2006) Weak localization in ultra-nano crystalline diamond. Applied Physics Letters. 88: (092107).
2. Auciello O, Krauss A R, Gruen D M, Meyer E M, Busmann H G, Tucek J, Sumant A, Jayatissa A, Moldovan N, Mancini D C and Gardos M N Two- and three-dimensional ultra-nano crystalline diamond (UNCD) structures for a high resolution diamond-based MEMS technology. Materials Research Society Symposium 605:73-78.
3. Dhote A M, Auciello O, Gruen D M and Ramesh R (2001) Studies of thin film growth and oxidation processes for conductive Ti-Al diffusion barrier layers via in situ surface sensitive analytical techniques. Applied Physics Letters 79:800-802.
4. Busmann H G, Pageler A, Brauneck U and Gruen D M (2000) Grain boundaries and mechanical properties of nanocrystalline diamond films. Journal of Metastable and Nanocrystalline Materials 8:255-260.
5. Auciello O, Krauss A R, Jaemo I M, Dhote A, Gruen D M, Aggarwal S, Ramesh R, Irene E A, Gao Y and Mueller A H (1999) Studies of ferroelectric heterostructure thin films, interfaces, and device-related processes via in situ analytical techniques. Integrated Ferroelectrics 27:103-118.

Biograpy

Dieter M Gruen is an Argonne Distinguished Fellow, Emeritus and President of Dimerond Technologies, LLC's. He has completed his BS cum laude and MS degrees at Northwestern University and his PhD in Chemical Physics at University of Chicago. He had a distinguished research career involving several disciplines of material science relevant to fission and fusion energy.

dietergruen@comcast.net

Bin Zhu, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-019

21st International Conference on

Advanced Materials & Nanotechnology

September 04-06, 2018 | Zürich, Switzerland

Bin Zhu

Hubei University, China

Semiconductors and semiconductor ionic hetero-structure composites for next generation energy conversion technology

Studies on ionic mobility in semiconductor lead to new generation electron and semiconductor devices, e.g., Displays, valve switches, new memory devices, superconducting devices, super magnetic devices, electro chemical transistors, low-power electronics and novel sensing energy devices etc., but ionic properties and transports missing that has the same or more important significance than ionic effects on electrons, because the electronic effect on ions and movement to be widely applied for new generation energy technologies. Over hundred years, people have designed and looked for ionic conductors and ionic conductivity only focusing on so called ionic materials or conductors, but challenge unsolved, typically, solid oxide fuel cell (SOFC), yttrium stabilized zirconia (YSZ), which needs high operational temperature in excess of 700°C to operate properly, dominated the SOFC technology over hundred years, not yet commercially. The traditional ionic electrolyte, e.g., YSZ can be now replaced by semiconductor and semiconductor ionic properties and materials we have developed to demonstrate higher device performance at temperatures well below 600°C and much simpler technology, e.g., single component fuel cell to replace traditional anode, electrolyte and catholic three components fuel cell technology. Turning to semiconductors, to develop semiconductor ionic property and conductivity, we can reach ever higher ion conductivity which has demonstrated better fuel cell performance and simpler technology. Semiconductor and semiconductor-ionic hetero structure composites are leading to next generation energy devices.

Recent Publications

1. Zhu B, Raza R, Abbas G and Singh M (2011) An Electrolyte-Free Fuel Cell Constructed from One Homogenous Layer with Mixed Conductivity. Advanced Functional Materials 21:2465-2469
2. Zhu B, Raza R, Qin H, Liu Q and Fan L (2011) Fuel cells based on electrolyte and non-electrolyte separators. Energy & Environmental Science 4(8):42986-2992.
3. Zhu B, Qin H, Raza R, Liu Q, Fan L, Patakangas J and Lund P (2011) A single-component fuel cell reactor. International Journal of Hydrogen Energy 36:8536-8541.
4. Zhu B, Raza R, Qin H and Fan L (2011) Single-component and three-component fuel cells. Journal of Power Sources 196(15):6362-6365.
5. Zhu et al. (2013) A new energy conversion technology based on nano-redox and nano-device processes. Nano Energy 2(6):1179-1185.

Biograpy

Bin Zhu received MSc degree from University of Science and Technology of China in 1987 and PhD from Chalmers University of Technology, Physics and Engineering Physics, Sweden in 1995. During October 1995 to December 1997, he worked as Postdoc at Uppsala University, Ångström Laboratory. Since 1998, he moved to KTH and in 1999 became Associate Professor in Department of Chemical Engineering and Technology, and now in Department of Energy Technology, KTH. He is a Visiting Professor at Aalto University and Nanyang Technological University as well as he acted as Guest Professor and Professor at several Chinese universities to co-supervise research projects and PhD students. From 2018, he has been appointed as Visiting Professor, an honorary appointment at Loughborough University, UK.

binzhu@kth.se

conferenceseries.com

21st International Conference on

Advanced Materials & Nanotechnology

September 04-06, 2018 | Zürich, Switzerland

Keynote Forum

Day 2

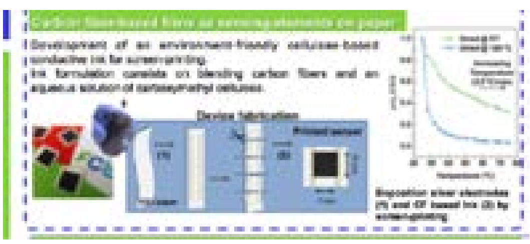
Rodrigo Martins, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-019

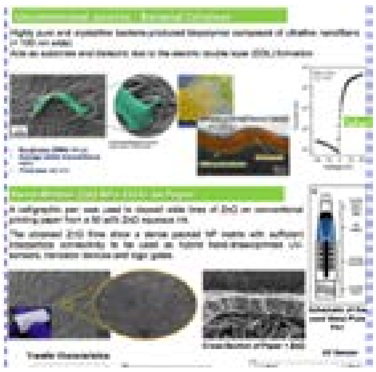
Rodrigo Martins

Universidade NOVA de Lisboa, Portugal

Driving flexible electronics by hybrid materials

Printable electronics and flexible electronics are the key areas of development world-wide once offer the potential to add functionality to everyday objects at very low costs that would be difficult with conventional technologies. This was pushed by the large success of organic electronics over the past few decades due to their attractive features such as low process temperatures, good mechanical flexibility, light weight and the possibility to use a wide range of substrates and being recyclable. Besides that we can prepare these devices using inexpensive solution processes over large areas. These benefits offered by printable and embedded electronics have been recognized in many sectors. Nevertheless the bottle neck here is the low electronic performances so far achieved. On the other hand, metal oxide electronic materials are quite attractive since they are reliable, able to be process at low temperature and present excellent electronic performance at 1-2D scales, providing so a large variety of different and possible applications, going from low costs to high complex systems able to compete with silicon in applications like transparent electronics, optoelectronics, magneto electronics, photonics, spintronics, thermo-electrics, piezoelectrics, power harvesting, hydrogen storage and environmental waste management. In terms of production techniques, RF magnetron sputtering has been well established and has demonstrated high performance devices, as ALD. However, these require complex equipment's, especially if we are targeting low cost applications. In contrast, the solution process has many advantages such as large-area deposition, roll-to-roll capability and easy control of composition, atmospheric processing and low cost. In parallel, we have been observing a rapid and growing interest concerning the utilization of biological materials for a wide range of applications. One of the most representative example is cellulose, not only in the form of raw material mainly for pulp and paper production, but also in the development of advanced materials/products with tailor-made properties, especially the ones based on nanostructures, for low cost and disposable applications. In this presentation, we will review the main applications of vegetal and bacterial cellulose in electronics, either as substrate (passive) or as a real electronic material (active), taking into account the expertise as well as the major developments already done at CENIMAT|i3N in the area of paper electronics.





Recent Publications

1. António T Vicente, Andreia Araújo, Manuel J Mendes, Daniela Nunes, Maria J Oliveira, Olalla Sanchez-Sobrado, Marta P Ferreira, Hugo Águas, Elvira Fortunato and Rodrigo Martins (2018) Multifunctional cellulose-paper for light harvesting and smart sensing applications. Journal of Materials Chemistry C 6(13):3143-3181.
2. I Cunha, R Barras, P Grey, D Gaspar, E Fortunato, R Martins and L Pereira (2017) Reusable cellulose based hydrogel sticker film applied as gate dielectric in paper electrolyte gated transistors. Advanced Functional Materials 27(16):1606755.
3. A Araujo, A Pimentel, M J Oliveira, M J Mendes, R Franco, E Fortunato, H Águas and R Martins (2017) Direct growth of plasmonic nano rod forests on paper substrates for low-cost flexible 3D SERS platforms. Flexible and Printed Electronics 2(1):0140016.
4. R Barras, I Cunha, D Gaspar, E Fortunato, R Martins and L Pereira (2017) Printable cellulose-based electro conductive composites for sensing elements in paper electronics. Flexible and Printed Electronics 2(1):014006.
5. A Pimentel, A Araujo, B J Coelho, D Nunes, M J Oliveira, M J Mendes, H Aguas, R Martins and E Fortunato (2017) 3D ZnO/Ag surface-enhanced Raman scattering on disposable and flexible cardboard platforms. Materials 10(12):1351.

Biography

Rodrigo Martins is a full time Professor and Head of Materials Science Department, Faculty of Science and Technology at New University of Lisbon. He is the Director of The Centre of Excellence in Microelectronics and Optoelectronics Processes of Institute of New Technologies; President of the European Academy of Science; Head of the Group of Materials for Electronics, Optoelectronics and Nanotechnologies of the Research Materials Center of the Institute for Nanostructures, Nano-modeling and Nanofabrication, CENIMAT/I3N; Chair of the European Committee Affairs of European Materials Research Society and the Global Leadership and Service Award Committee of the International Union of Materials Research Societies; Member of the Journal Management Committee for the *Journal NPJ 2D Materials and Applications*. His area of expertise is related to functional materials for electronics and energy applications. He pioneers worldwide work in the field of Transparent Electronics and is one of the Inventors of Paper Electronics.

rm@uninova.pt

Notes:

Jhinhwan Lee, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-019

21st International Conference on

Advanced Materials & Nanotechnology

September 04-06, 2018 | Zürich, Switzerland

Jhinhwan Lee

KAIST, South Korea

Switching iron-based superconductivity with spin current

We have explored a new mechanism for switching magnetism and superconductivity in a magnetically frustrated iron-based superconductor using spin-polarized scanning tunneling microscopy (SPSTM). Our SPSTM study on single crystal Sr_2VO_3FeAs is made up of alternating self-assembled FeAs monolayer and Sr_2VO_3 bilayers shows that a spin-polarized tunneling current can switch the FeAs-layer magnetism into a non-trivial C4 (2×2) order, which cannot be achieved by thermal excitation with unpolarized current. Our tunneling spectroscopy study shows that the induced C4 (2×2) order has characteristics of plaquette antiferromagnetic order in the Fe layer and strongly suppresses superconductivity. Also, thermal agitation beyond the bulk Fe spin ordering temperature erases the C4 state. These results suggest a new possibility of switching local superconductivity by changing the symmetry of magnetic order with spin-polarized and unpolarized tunneling currents in iron-based superconductors. We have also performed high-resolution quasiparticle interference (QPI) measurements, self-consistent BCS-theory-based QPI simulations and a detailed e-ph coupling analysis to provide direct atomic-scale proofs of enhancement of iron-based superconductivity due to the BCS mechanism based on forward-scattering interfacial phonons.

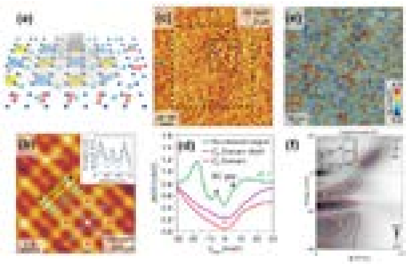


Figure-1: (a), (b) Atomic scale evidence of plaquette antiferromagnetic order induced in FeAs layer of Sr_2VO_3FeAs by injection of spin-polarized tunneling current and (c), (d) resultant local switching-off of iron-based superconductivity. (e)-(f) Quasiparticle-interference signature of enhancement of iron-based superconductivity due to C_2 defects locally enhancing e-ph coupling with the forward-scattering interfacial phonons.

Recent Publications

1. Jin-Oh Jung, Jhinhwan Lee, et al. (2017) Versatile variable temperature and magnetic field scanning probe microscope for advanced material research. *Review of Scientific Instruments;* 88: 103702.
2. Jhinhwan Lee (2017) Real-time digital signal recovery for a multi-pole low-pass transfer function system. *Review of Scientific Instruments;* 88: 085104.

Biography

Jhinhwan Lee has completed his Bachelor's degree from Seoul National University (1995). After obtaining his PhD degree from the same institution, he joined Professor J C Davis' Laboratory at Cornell University as a Postdoctoral Associate and was appointed Research Associate in 2007. He went to Korea Advanced Institute of Science and Technology as Assistant Professor and began his life-long investigations on magnetism and unconventional superconductivity. He has received Korea Physical Society Bombee Physics award in 2004 and the Albert Nelson Marquis lifetime achievement award in 2018. His works includes bandgap engineering of nanotube published in nature; scanning probe microscope for advanced material research is published as a cover paper in *Review of Scientific Instruments (*2017) and switching iron-based superconductivity using spin current published in Physical *Review Letters* with Viewpoint (2017).

jhinhwan@gmail.com