May/June 2012 • No. 213

ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

Hello ESA Colleagues,

I hope I'm not becoming too repetitive in my messages, by focusing on my travels -- but this has been an unexpected benefit arising from my involvement with the ESA.

I'm writing this message from the airport in Cairo, on a layover on my way home from Botswana. I teach an engineering course and run a summer research program in Botswana in collaboration with my Case Western colleague (and ESA member) Mohan Sankaran. This year these two programs involved 30 students from the United States and 7 students from Botswana. As I wrote a few newsletters ago, the genesis of these programs was a discussion with Rufus Akande at the 2008 ESA meeting (Rufus is on the faculty at the University of Botswana).

I'm returning home after leading the first half of these programs, and Mohan recently arrived to lead the second half. Mohan and I overlapped for the 3-day safari in the Okavango Delta region of Botswana, where we brought the students for a break midway through their programs. We camped in a secluded area, with no people around for miles ... but we did have elephants pass right next our campsite, and a leopard cut right through the middle! We also saw many giraffe, zebra, hippo, buffalo, and wildebeest, as well as other animals. I had to leave a little early for my flight home, but Mohan and the students stayed longer and also saw lions.

This layover in Cairo is only a few hours, and I'm staying in the airport. But my Cairo layover on the way to Botswana was 11 hours, so I was able to leave the airport and go see the pyramids at Giza.

It is amusing for me when I reflect that the safari and visit to the pyramids would not have occurred if it weren't for my involvement with the ESA!

My next trip, of course, is the Joint Electrostatics Meeting in Cambridge, Ontario. As you may have noticed, I enjoy building in exciting travel destinations on my business trips. I encourage you to do the same on your trip to this meeting. Niagara Falls – widely considered to be one of the top three waterfalls in the world -- is about an hour away from the meeting site. The conference organizers have arranged a trip to Niagara Falls on the Friday of the conference week (the day after the technical sessions end). I highly recommend taking advantage of this opportunity to visit one of the world's most impressive sights. You should contact the Conference Chair, Shesha Jayaram (*jayaram@uwaterloo.ca*), for more information.

I look forward to seeing you soon at the Joint Electrostatics Meeting!

Dan Lacks,
President, ESA
daniel.lacks@case.edu

ESA 2012: Electrostatic Demonstrations Workshop

Below is the final program for the Electrostatics Demonstration Session scheduled to take place in the evening of Tuesday, 12 June 2012. We are very fortunate to have presenters coming from Japan, Sweden, and the UK, as well as the USA. This session will be quite informal with the emphasis on learning and fun. And there will be pizza, snacks, and beverages provided!

The beginnings of electrostatics - demonstration of the high school Van de Graaff
Mr. Shethar Davis

Electrostatic demonstrations with the electrophorus
Prof. Thomas B. Jones

Static discharges caused by cleanup after spills
Mr. Shonosuke Kamachi

Storing Charge in Wound Rolls
Dr. Kelly S. Robinson

How easy it is to generate ESD
Dr. Jeremy M. Smallwood

Liquid charging during filtration operation
Mr. Anders Thulin

Electrostatic measurements on webs
Mr. William Vosteen

The first Xerox copier
Mr. William H. Wayman

I hope all ESA members will look forward to this unique ESA event.

Tom Jones
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ESA Award Nominations

The ESA is accepting nominations for the following awards:

The **ESA Distinguished Service Award** recognizes outstanding service to the ESA over an extended period of time, with a demonstrated long-term commitment to the growth and continued well-being of the Society (requirement: 10 years as ESA member).

The **ESA Lifetime Achievement Award** recognizes outstanding contributions to the field of Electrostatics, as shown by the pervasiveness of the contributions in understanding certain problems or important practical benefits resulting from the work (requirement: 10 years working in field of Electrostatics).

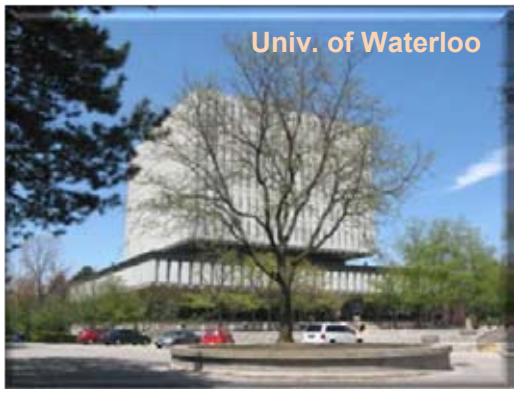
The **ESA Honorary Life Member Award** recognizes exceptional contributions to both the ESA and to the field of Electrostatics, sustained over much of a career (requirements: 10 years as ESA member, 20 years working in field of Electrostatics).

The **Teacher of the Year Award** recognizes outstanding teachers who use Electrostatics to stimulate learning, inspire students, or otherwise encourage and energize the learning process in a formal educational setting in grades K-12 (requirement: 3 years teaching Electrostatics).

The **Student of the Year Award** recognizes middle or high school students who demonstrate outstanding achievement in Electrostatics, as showcased in laboratory projects, papers or presentations.

Nominations should be submitted electronically to the ESA Award Chair, Prof. Raji Sundararajan at *rsundara@purdue.edu*, by May 15 of each year. The nomination should be in the form of a letter from an ESA member that includes a description of how the accomplishments of the nominee satisfy the award requirements (including citations of publications or patents when relevant), the contact information of the nominator and nominee, and the names and contact information of 3 other ESA members who endorse the nomination. For the Teacher and Student awards, endorsements from two faculty members of the nominee's should substitute for the ESA member endorsements.

The ESA is also accepting nominations for induction to the Electrostatic Hall of Fame. This honor recognizes and records for posterity those individuals who have made extraordinary contributions to the field of Electrostatics. Nominees do not need to be still living. The Hall of Fame has three categories: (I) advancement of the fundamental knowledge of Electrostatics; (II) promotion of interest in the field of Electrostatics; (III) innovations using Electrostatics technology in industry. Nominations should be submitted electronically to the ESA Award Chair, , Prof. Raji Sundararajan at *rsundara@purdue.edu*, by May 15 of each year. The nomination should be in the form of a letter from an ESA member that includes a description of how the accomplishments of the nominee satisfy the award requirements (including citations of publications or patents when relevant), the contact information of the nominator and nominee, and the names and contact information of 3 other ESA members who endorse the nomination.



2012 Electrostatics Joint Conference

Cambridge-Hespeler Galt Holiday Inn
Cambridge, Ontario, Canada, June 12-14, 2012
http://www.electrostatics.org/conferences.html

June 12: Conference begins (8AM)
June 12 (evening): Electrostatics Demonstrations Session and UW campus tours
June 13: Conference continues, evening poster session
June 14: Conference ends after evening banquet
June 15: Optional Niagara Falls Day Trip
(details at http://www.electrostatics.org/images/Niagara_Trip.pdf)

University of Waterloo Research Labs: In addition to the electrostatics demonstrations described on the previous page, visits to other world class laboratories on UW campus are arranged. The visit will include the High Voltage Engineering Laboratory (HVEL), the Institute for Quantum Computing (IQC), and Waterloo Advanced Technology Laboratory (WatLab). HVEL is a leading research and teaching laboratory in the field of insulation, applied electrostatics, nanodielectrics, pulse power applications, and power electronics. In IQC's state-of-the-art laboratories, researchers explore quantum information through experiments in optics, nanoelectronics, nuclear magnetic resonance, quantum sensors and more. This research has created a wealth of new knowledge, and is already spawning the first wave of practical quantum technologies. WatLab consists of two fully operational state-of-the-art materials analytical systems: an ultrahigh resolution scanning electron microscope and a multi-technique imaging ESCA microprobe system.

Local Attractions: During your visit several sightseeing attractions can be enjoyed in the Waterloo Region. For those who are interested in nature, Niagara Falls is the best choice with views of one of the greatest waterfalls in the world. Historical and cultural sights include the Royal Ontario Museum (ROM) and CN Tower in Toronto, Dundrun Castle in Hamilton, University of Guelph Arboretum in Guelph, Covered Bridge in Waterloo and the Elora Gorge Conservation Area.

Conference Hotel: The Cambridge-Hespeler Galt Holiday Inn (200 Holiday Inn Dr., Cambridge, Ontario) is located right on the Macdonald-Cartier Freeway (highway 401). If you are flying into the Pearson International Airport, please make your reservation through "Airways Transit". If you have a reservation, it is their responsibility to bring you to the hotel, and safely take you back to meet your flight timings. You can make the reservation from the conference webpage or using the following link: http://www.holidayinn.com/hotels/us/en/cambridge/ycmca/hoteldetail?groupCode=ESA,

Contact Information:
Technical Chair: Prof. Maciej A. Noras, University of North Carolina at Charlotte, *mnoras@uncc.edu*, (704) 687-3735
General Chair: Prof. Shesha Jayaram, University of Waterloo, *jayaram@uwaterloo.ca* (519) 888-4567 ext.: 35337

Current Events

The Mystique of Electrostatics as used to Deceive Gullible Investors

I recently received an announcement in the mail from Stock Digest, http://www.stocksdigest.com/stock-report/sefe/, who presents themselves as a credible evaluator of new investments, regarding an investment opportunity. The company, SEFE http://sefelectric.com/, is developing an energy harvesting system based upon the use of balloons to collect atmospheric ions and convert them into usable energy. I immediately recalled Joe Crowley's paper: "The Fair-Weather Atmosphere as a Power Source" presented at last year's ESA Conference in Cleveland (http://www.electrostatics.org/images/A2.pdf). Joe's paper presented calculations of the capability of a reasonably sized collector, which turned out to be a few watts of power. The cost of the energy is free, but the cost of the hardware necessary for these few watts makes this a cost prohibitive technology.

Additional internet searching of SEFE directed me to Seeking Alpha, a website that shares research and analysis of publicly traded companies. They did an article on SEFE and feel that it's likely to be a "Pump and Dump" campaign, or in other words, an investment fraud.

(http://seekingalpha.com/article/554371-sefe-inc-s-hot-air-balloon-about-to-burst?source=yahoo)

It's sad how science is used to deceive the average citizen, whether it be in investments or in health or medical related subjects. Buyer beware.

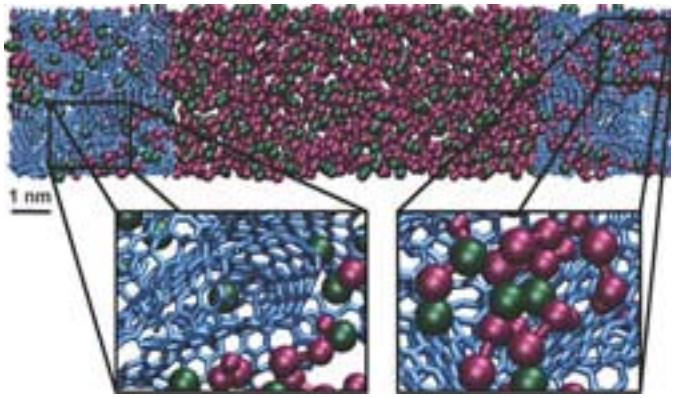
A jump forward in understanding the nature of supercapacitors

An international team of materials researchers including Drexel University's Dr. Yury Gogotsi has given the engineering world a better look at the inner functions of the electrodes of supercapacitors—the low-cost, lightweight energy storage devices used in many electronics, transportation and many other applications. In a piece published in the March 4 edition of Nature Materials, Gogotsi, and his collaborators from universities in France and England, take another step toward finding a solution to the world's demand for sustainable energy sources. What the group has produced is the first quantitative picture of the structure of ionic liquid absorbed inside disordered microporous carbon electrodes in supercapacitors. Supercapacitors have the capability of storing and delivering more power than batteries; moreover, they can last for up to a million of charge-discharge cycles. These characteristics are significant because of the intermittent nature of renewable energy production.

According to the researchers, the excellent performance of supercapacitors is due to ion adsorption in porous carbon electrodes. The molecular mechanism of ion behavior in pores smaller than 1 nm remains poorly understood. The mechanism proposed in this research opens the door for the design of materials with improved energy storage capabilities.

The authors suggest that in order to build higher-performance materials, researchers should know whether the increase in energy storage is due to only a large surface area or if the pore size and geometry also play a role. The results of this study provide guidance for development of better electrical energy storage devices that will ultimately enable wide utilization of renewable energy sources.

(excerpted from http://rdmag.com/News/2012/03/Materials-Electricity-Energy-Storage-A-jump-forward-in-understanding-the-nature-of-supercapacitors/)



The figure above (Molecular Dynamics simulations by the group of Mathieu Salanne): shows ionic liquid surrounded by two porous carbon electrodes. It explains how the positive (red) and negative (green) ions interact with the carbon surface. The charging mechanism involves the exchange of ions between the bulk and the electrode. This simulation yields much higher capacitance values than in models using simplified regular electrode geometries.

Exotic Material Shows Promise as Flexible, Transparent Electrode

Mike Ross

An international team of scientists with roots at SLAC and Stanford has shown that ultra-thin sheets of an exotic material remain transparent and highly conductive even after being deeply flexed 1,000 times and folded and creased like a piece of paper. The result could open this class of unusual materials, called topological insulators, to its first practical applications: flexible, transparent electrodes for solar cells, sensors and optical communications devices.

Researchers led by Shen, Zhongfan Liu and Hailin Peng of Peking University in China, and Yulin Chen of Oxford

Current Events (cont'd.)

University in England published their results last week in Nature Chemistry. Until recently, Peng and Chen were graduate students and postdoctoral researchers at Stanford and SIMES. They have continued to collaborate with Shen's research team after being named professors at their current universities.

The researchers made and tested samples of a compound in which sheets of bismuth and selenium, each just one atom thick, alternate to form five-layer units. The bonds between the units are weak, allowing the overall material to flex while retaining its durability. And as a topological insulator – a new state of quantum matter – the material conducts electricity only on its surface while its interior remains insulating, an unexpected property with unknown potential for fundamental research and practical applications.

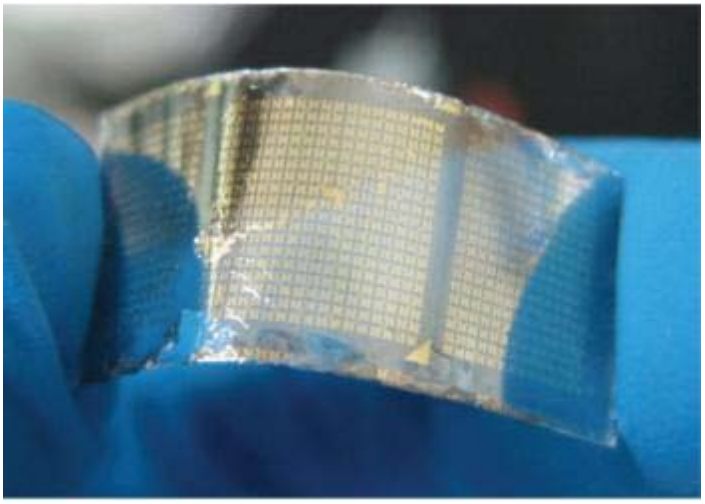
Since surface atoms dominate the structure of bismuth selenide, it is an exceptionally good electrical conductor – as good as gold. Unlike gold, however, bismuth selenide is transparent to infrared light, which we know as heat. While about half the solar energy that hits the Earth comes in the form of infrared light, few of today's solar cells are able to collect it. The transparent electrodes on the surfaces of most cells are either too fragile or not transparent or conducting enough. The new material could get around that problem and allow cells to harvest more of the sun's spectrum of wavelengths. The researchers' experiments also showed that bismuth selenide does not degrade significantly in humid environments or when exposed to oxygen treatments that are common in manufacturing.

"In addition to being a scientific success," Chen said, "this demonstration should alert engineers and companies that topological insulators can also be important commercially."

Peng added, "Infrared light pulses carry phone calls and data through optical fiber networks, so bismuth selenide may be useful in communications devices. This material could also improve infrared sensors common in scientific equipment and aerospace systems."

Peng and colleagues made the bismuth selenide samples and conducted the flexing, conductivity and transparency tests in China. The researchers confirmed that the samples were topological insulators at the Stanford Synchrotron Radiation Lightsource's Beam Line 5-4 at SLAC.

(excerpted from *https://news.slac.stanford.edu/features/exotic-material-shows-promise-flexible-transparent-electrode*)



An array of microcircuits made of a 10-nanometer-thick film of bismuth selenide, an exotic material called a topological insulator, on an insulating mica substrate can be flexed without damaging its... (Photo by Hailin Peng, Peking University)

ESA Officers

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Shesha Jayaram, Univ. of Waterloo
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Sheryl Barringer, Ohio State Univ.
Kelly Robinson, Electrostatic Answers, LLC
Rajeswari Sundararajan, Purdue Univ.

Calendar

- ESA-2012, Joint ESA/IEJ/IAS/SFE Meeting, June 12-14, 2012, Univ. of Waterloo, Waterloo, Ontario, Canada, Contact: Shesha Jayaram, *jayaram@uwaterloo.ca,* website: http://www.electrostatics.org
- 8th Conf. of the French Society of Electrostatics (SFE), July 3-5, 2012, Cherbourg, France, Contact: Jean-Michel Reboul, Ph: (33) 2 33 01 42 04, *jean-michel.reboul@unicaen.fr,* website: http://www.chbg.unicaen.fr/sfe/?lang=en
- ICAES-2012, 7th Int'l. Conf. on Applied Electrostatics, Sept. 17-19, 2012, Dalian Univ. of Tech., Dalian, China, Contact: Secretariat Office, Ph: +86 411 84708576-604, *ICAES2012@163.com,* website: http://www.icaes-2012.org/windows/index.htm
- 12th Int'l. Conf. of Electrostatics, Electrostatics - 2013, April 2013, Budapest, Hungary, Contact: *info@electrostatics2013.org* website: http://www.electrostatics2013.org/

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