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ESA Newsletter
Electrostatics Society of America - The Friendly Society

President's Message

Dear ESA Colleagues,

Being a part of the ESA recently helped me out of a big problem…

I teach the chemical engineering capstone project course at my university (Case Western Reserve). In this course, student teams work on projects in conjunction with outside companies; each team, composed of 3-4 students, works with a different company. The projects are defined by the companies, and involve real issues current at the company. All projects involve "design" – i.e., open ended problems with no one solution or route, and which include an economic analysis and account for possible safety and environmental issues. Aside from this design component, the nature of the projects varies, depending on the needs of each company. The course is taught in the Spring semester, but arrangements must be made beforehand. I line up the companies by November. Students are given their assignment in December and arrange a meeting with the company during the first week the semester (this year the semester began January 12).

All was set up for the course this year … until I received an email in mid-December saying that my contact at one of the companies was leaving his job, and the company would not be able to host a project. To make things more difficult, I was traveling out of the country until December 22, and would again travel out of the country from January 2 until January 10. And, of course, many people are on vacation between December 22 and January 2. When I was home in late December I developed a promising lead – an engineer told me his company may be able to host a project, but he would have to confirm with his colleagues, who would not be back at work until after the holidays. I was hopeful things would work out with this company.

But on January 6, while in Lesotho (Africa), I received an email that this new company would not be able to host a project. At this point, the semester was starting in six days and one of the teams didn't have a project. And it was difficult for me to do much to address this problem while I was in Africa. I was really in trouble!

I desperately needed help right away. So I turned to an ESA colleague – Kelly Robinson, who runs the electrostatic consulting firm Electrostatics Answers. Over the past 8 years Kelly and I interacted a lot on ESA matters, and Kelly has also given me good advice on research matters (we even co-authored a journal article). I emailed Kelly asking if Electrostatic Answers could host a project. Within a few hours I got an email that Electrostatic Answers will be participating, and the project was described.

The project worked out great. In fact, the Electrostatic Answers team won the end-of-semester poster competition in the course.

As my term as ESA President is ending, I have been reflecting on the ways that ESA has helped me professionally. I began research in electrostatics mid-career, and I started coming to the ESA meetings nine years ago in order to hear talks from leaders whose work I had been following in the literature, such as Peter Castle and Malay Mazumder. But the benefits from my being a part of the ESA turned out to be much more than I could have expected. The example that I relate above is just one of many:

- A few years ago, when I was looking for more companies for my senior design course, ESA member Steve Cooper arranged for Sunless Inc. to host a project.

(cont'd. p. 2)

President's Message (cont'd.)

- While I was visiting Yangon Technological University in Myanmar, a faculty member asked me to give a lecture on food science (which I know nothing about). I contacted ESA member Sheryl Barringer, and I was able to give a presentation describing her research on the electrostatic adhesion of seasonings to food.

- Our lab was studying effects of stress on charge transfer, but we were stuck because the surface potentials we were trying to measure were beyond the range of our instrument. Fortunately, ESA member Maciej Noras taught us a trick to overcome this issue, and this work led to one of our best papers.

- When we needed to build in-house electrometers for our experiments, but had no idea how to do it, we got guidance from ESA members Tatsushi Matsuyama and Karen Aplin, and were successful in building the electrometers.

- After our presentation at an ESA meeting, Kelly Robinson pointed out (in a very nice way) that a calculation we were doing was flawed. We collaborated with Kelly to carry out the calculations correctly, and this led to a nice paper (with Kelly as a co-author).

- As of 2010 I had never been to Africa. But discussions at an ESA meeting with Rufus Akande led me and my CWRU colleague (and ESA member) Mohan Sankaran to develop academic and research programs in Botswana, which have now brought over 150 US students to Africa and given us high visibility at our university.

- I first met David Go at an ESA meeting; now David, Mohan Sankaran and I work together on a $1.5 million project funded by the Air Force Office of Scientific Research to study the use of plasmas to control catalytic reactions.

- I collaborated with ESA member Peter Castle to write the "Triboelectrification" entry in the Encyclopedia of Electrical and Electronics Engineering published by Wiley.

- One of the highlights of my professional career was serving as the "opponent" for Maija Nyström's PhD defense at the University of Turku in Finland. Maija and her advisor, Matti Murtomaa, are both ESA members. While I have served on many PhD defense committees, this one was very different – it was carried out in white-tie attire!

- Finally, my interactions with ESA member Mark Horenstein led to my becoming Editor-in-Chief of the Journal of Electrostatics when Mark decided to retire from this position. I started this position a few weeks ago, and I consider it to be one of the greatest honors of my career.

I am very grateful for the connections I have made through the ESA!

I look forward to seeing many of you in June at Cal Poly Pomona, for our Annual Meeting.

Regards,
Dan Lacks
President, Electrostatics Society of America
daniel.lacks@case.edu

ESA Officers

President:
Dan Lacks, Case Western Reserve Univ.
Vice President and Awards Chair:
Shesha Jayaram, Univ. of Waterloo
Executive Council:
Sheryl Barringer, Ohio State Univ.
Kelly Robinson, Electrostatic Answers, LLC
Rajeswari Sundararajan, Purdue Univ.

Calendar

- 33rd EIC (Elec Insul Conf, IEEE-DEIS), June 7-10, 2015, Seattle, WA, USA, *http://sites.ieee.org/eic/* Contact: Bill McDermid, *wmmcdermid@hydro.mb.ca*
- ESA 2015, June 16-18, 2015, California State Polytechnic University, Pomona, CA, USA, *http://www.electrostatics.org/conferences.html* Contact: Keith Forward, *kmforward@csupomona.edu*
- 3rd ISNPEDADM, Oct. 25-30, 2015, Le Recif Hotel, Saint Gilles les Bains, Reunion, *http://isnpe-dadm2015.conference.univ-poitiers.fr/* Contact: Gerard Touchard, *gerard.touchard@univ-poitiers.fr*

2015 Annual Meeting of the Electrostatic Society of America

California State Polytechnic University, Pomona
Pomona, CA
June 16 - 18, 2015

California State Polytechnic University, Pomona (Cal Poly Pomona) is proud to be hosting the 2015 Annual Meeting of the Electrostatic Society of America (ESA). The meeting will bring together experts across the diverse field to present the latest developments in electrostatics.

Anticipated Technical Session Topics

- Contact charging and triboelectric effects
- Gas discharges and microplasmas
- Breakdown phenomena, safety and hazards
- Electrically-induced flows and electrokinetics
- Atmospheric and space applications
- Biological and medical applications
- Electrospinning and material processing
- Measurements and instrumentation

Important Dates

March 15	Notification of abstract acceptance
May 10	Early registration deadline
May 17	Final manuscript deadline
June 16	Conference begins (9 AM)
June 17	Conference banquet (evening)
June 18	Conference ends (noon)

Keynote Speakers

- **Dr. Matti Murtomaa**, University of Turku
- **Dr. Zhong Lin Wang**, Georgia Institute of Technology
- **Dr. Kim Woodrow**, University of Washington
- **Dr. Leslie Yeo**, Royal Melbourne Institute of Technology

Conference information, including abstract submission, registration, student travel grants and lodging, will be updated and available at *http://www.electrostatics.org*

Conference Chair
Prof. Keith M. Forward
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Cosmic Rays used to Model Thunderclouds on Earth

Radboud University

How is lightning initiated in thunderclouds? This is difficult to answer — how do you measure electric fields inside large, dangerously charged clouds? It was discovered, more or less by coincidence, that cosmic rays provide suitable probes to measure electric fields within thunderclouds. This surprising finding is published in Physical Review Letters on April 24. The measurements were performed with the LOFAR radio telescope located in the Netherlands.

"We used to throw away LOFAR measurements taken during thunderstorms. They were too messy." says astronomer Pim Schellart. "Well, we didn't actually throw them away of course, we just didn't analyze them."

Schellart, who completed his Ph.D. in March this year at Radboud University in Nijmegen and is supervised by Professor Heino Falcke, is interested in cosmic rays. These high-energy particles, originating from exploding stars and other astrophysical sources, continuously bombard Earth from space. High in the atmosphere these particles strike atmospheric molecules and create 'showers' of elementary particles. These showers can also be measured from the radio emission that is generated when their constituent particles are deflected by the magnetic field of the Earth. The radio emission also gives information about the original particles. These measurements are routinely conducted with LOFAR at ASTRON in Dwingeloo, but not during thunderstorms.

A particle shower initiated by a cosmic ray reaches LOFAR through a thundercloud. Courtesy of Radboud University.

That changed when the data were examined in a collaborative effort with astrophysicist Gia Trinh, Prof. Olaf Scholten from Groningen University and lightning expert Ute Ebert from the Centrum Wiskunde & Informatica in Amsterdam. "We modeled how the electric field in thunderstorms can explain the different measurements. This worked very well. How the radio emission changes gives us a lot of information about the electric fields in thunderstorms. We could even determine the strength of the electric field at a certain height in the cloud." says Schellart. This field can be as strong as 50 kV/m. This translates into a voltage of hundreds of millions of volts over a distance of multiple kilometers: a thundercloud contains enormous amounts of energy.

Lightning is a highly unpredictable natural phenomenon that inflicts damage to infrastructure and claims victims around the world. This new method to measure electric fields in thunderclouds will contribute to a better understanding and ultimately better predictions of lightning activity. Current measurement methods from planes, balloons or little rockets are dangerous and too localized. Most importantly, the presence of the measurement equipment influences the measurements. Cosmic rays probe the thunderclouds from top to bottom. Moving at almost the speed of light, they provide a near instantaneous 'picture' of the electric fields in the cloud. Moreover, they are created by nature and are freely available.

"This research is an exemplary form of interdisciplinary collaboration between astronomers, particle physicists and geophysicists," says Heino Falcke. "We hope to develop the model further to ultimately answer the question: how is lightning initiated within thunderclouds?"

(excerpted from *http://www.scientificcomputing.com/news/2015/04/cosmic-rays-used-model-thunderclouds-earth*)

Novel plastic could spur new green energy applications, 'artificial muscles'

Radboud University

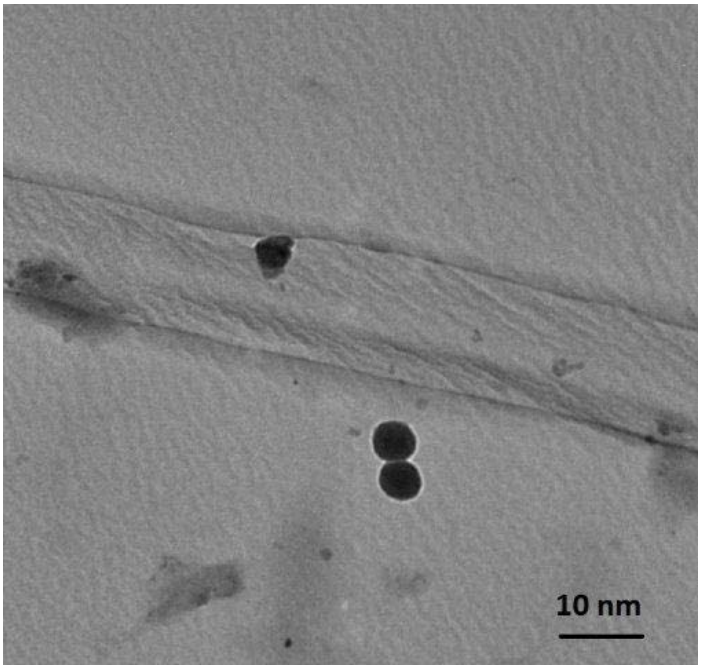
A plastic used in filters and tubing has an unusual trait: It can produce electricity when pulled or pressed. This ability has been used in small ways, but

now researchers are coaxing fibers of the material to make even more electricity for a wider range of applications from green energy to "artificial muscles." They will report progress on a novel form of this plastic at the 249th National Meeting & Exposition of the American Chemical Society (ACS).

"For the past couple of years, we've been doing a lot of work with a material called PVDF — polyvinylidene fluoride," explains Walter Voit, Ph.D., of the University of Texas at Dallas (UT Dallas). "If we produce it under precise conditions, we can make it piezoelectric, which means if I stretch it, it generates electricity. Or I can put electricity onto the surface of the material and make it change shape."

PVDF and other materials with similar traits have already made their way into modern technology in the form of pressure sensors in touchpads and tilt sensors in electronics, for example. But their potential, if their piezoelectric properties get a significant boost, could go far beyond these first-generation applications.

In collaboration with Shashank Priya, Ph.D., at Virginia Polytechnic Institute and State University, Voit has already made new progress toward this goal. They have led efforts to develop "soft" polymer-based, energy-harvesting materials as part of the Center for Energy Harvesting Materials and Systems, a National Science Foundation (NSF) program focused on the development of energy-capture and motion-control technologies.



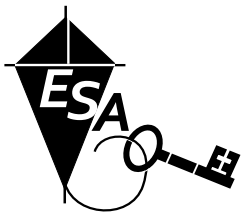
Carbon nanotubes (one shown above) and "buckyball" clusters (dark spots) are incorporated in a new material to boost its electricity-generating properties. Credit: Voit lab

Cary Baur, a doctoral student in Voit's lab, has figured out a way to incorporate organic nanostructures known as "buckyballs" and single-walled carbon nanotubes into PVDF fibers to double its piezoelectric performance. Buckyballs are tiny spheres made out of carbon atoms. They and their cylindrical relatives have interesting properties that scientists are harnessing in a variety of ways. In the case of Voit's materials, the carbon nanostructures even out and increase the overall strength of the electrical field. As a result, the PVDF-carbon hybrids are the best piezoelectric composites that have been reported to date in the scientific literature, Voit says.

To turn these yarn-like structures into artificial muscles — a catch-all name for materials that can contract or relax in response to an electric current or temperature — Voit needs to make them more powerful. One approach for accomplishing this was developed by a UT Dallas colleague. Ray Baughman, Ph.D., took a bundle of nylon fibers about the width of ten strands of human hair and wound them into a long, tight coil, just like an old-fashioned telephone cord but on a much smaller scale. That structure could contract by nearly 50 percent when heated and lift about 16 pounds. "The effect is similar to twisting a rubber band," Voit says. "If you pull on it when it's coiled, you get a lot more strain on the rubber band than if it's just straight."

Voit is looking to create a similar effect for his PVDF-carbon fibers, which are far better piezoelectric materials than nylon and would contract in response to an electric current. "We have to coil it," he says. "We have to have the right piezoelectric properties after it's in that complex shape. That's the real secret sauce that we think we can pull off. Ultimately, it could be used to build synthetic muscles that could make prosthetic limbs more life-like."

(excerpted from *http://www.acs.org/content/acs/en/pressroom/newsreleases/2015/march/novel-plastic-could-spur-new-green-energy-applications-artificial-muscles.html*)



ESA Information

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