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ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

Our 32nd Annual Conference/Meeting at the Rochester Institute of Technology was a great success in all aspects. The technical sessions were interesting with lively discussions that often ran into the breaks. On Tuesday night we had a very nice reception thanks to Glassman High Voltage and Trek, Inc. The quality and quantity of the food was exceptional. We truly appreciate the effort our international participants exert to attend our conferences. This year we had attendees from Canada, Africa, South Korea, Germany and England to complement our US contingency.

Ned Greene organized our student paper competition, which we hope will be the first of many to come. The winners were: 1st place - J. Casey Crager from Boston University, 2nd place - Hongjian (Rocket) Wei from University of Waterloo, and 3rd place - Saeed Ul Haq also from the University of Waterloo. A special thanks to all the winners, participants and, of course, Ned Greene for his organizational efforts.

During our annual board meeting it was decided that we will continue to have student paper competitions annually to promote interest and work in electrostatics. We will give all student participants free conference registration at all future conferences. Everyone in the academic realms should let their students know of our offer and encourage their participation in our annual conference and student paper competition.

Glen Schmieg entertained us with balloons this year during his after-dinner presentation at the annual banquet. A special thanks to Kelly Robinson for putting together such a well run conference in such a pleasant facility and another special thanks to Sheryl Barringer for organizing a well-rounded technical program. Thanks also go to Al Seaver for digitally capturing many of the conference attendees and putting them on the web for all to view: at: *http://www.electrostatics.us/esa/2004/page_01.jsp*

Good news!! Piotr Gefter and Scott Gehlke have volunteered to co-chair our 2006 Conference in Berkeley, California. This will be a joint conference with the IEJ, Japanese Electrostatic Society. This will also be the year of Ben Franklin's 300th birthday. A very special year indeed.

I hope everyone is having a good summer.

Bill Vosteen
ESA President

Current Events

New Molecule Heralds Breakthrough in Electronic Plastics

ARLINGTON, Va.—Researchers have developed a new plastic that conducts electricity, may be simpler to manufacture than industry counterparts and easily accommodates chemical attachments to create new materials.

Developed by TDA Research in Wheat Ridge, Colo., Oligotron polymers are made of tiny bits of material that possess a conducting center and two, non-conducting end pieces. The end pieces allow the plastic bits to dissolve in solvents and accommodate specialized molecules.

For decades, researchers have been trying to craft electronics that use plastics instead of metal to transmit currents. However, because conducting polymers initially were not soluble in liquids, they could not be manufactured as easily as could their common counterparts used in soda bottles and synthetic fibers. Recent discoveries resulted in a water-soluble conducting polymer called PEDOT (polyethylenedioxythiophene), yet water can corrode device parts during manufacturing and shorten the lifespan of the end product.

Oligotron, developed with National Science Foundation (NSF) Small Business Innovation Research (SBIR) support, contains a PEDOT center, but it is soluble in non-corrosive chemicals and can attach new compounds to its end pieces, adding a variety of functions. For example, researchers have proposed end pieces that convert solar energy into electricity, ultimately creating a novel solar cell material.

Oligotron also has special properties that allow the material to be "printed" into various device shapes. When technicians shine a pattern of ultraviolet light, such as a complex circuit image, onto a film of dissolved Oligotron, the exposed areas of plastic become "fixed" like a photograph. Flexible and lightweight, the circuit is also fully functional.

TDA researchers predict applications for the product that range from flexible television displays and smart cards to antistatic treatments and conducting fabrics.

Oligotron is a trademark of TDA Research, Inc.

for more info.
http://www.nsf.gov/od/lpa/newsroom/pr.cfm?ni=73

Sixth Sense
Probing the world by means of electric auras

Peter Weiss, Science News, Week of June 19, 2004; Vol. 165, No. 25 , p. 392

(courtesy of Anne Benninghoff and Stuart Hoenig)

A decade ago, Philip H. Rittmueller was a man on a mission. By the early 1990s, the automobile industry knew that airbags, while successful at saving lives in crashes, could also prove deadly to children and small adults (Science News: 9/26/98, p. 206: http://www.sciencenews.org/pages/sn_arc98/9_26_98/bob3.htm). As an engineer with NEC Technologies Automotive Electronics Division at that time, Rittmueller was looking for a technological fix for this lethal threat. Yet none of the approaches Rittmueller knew about for the automatic sizing up of car seat occupants—including weight sensing, ultrasonic scanning, and optical imaging—seemed good enough. "I was looking under all sorts of rocks," Rittmueller recalls.

Then, in the fall of 1994 at the Massachusetts Institute of Technology, Rittmueller found the right rock. He was visiting the university's hotbed of invention, known as the Media Lab, when he saw what looked like a throne flanked by two lighted Plexiglas poles, and he viewed a startling video showing how such a "spirit chair" was used in magic shows by the famous duo Penn and Teller.

In the video, Penn sat in the chair. As he gestured wildly with both hands and feet, drums, trumpets, cymbals, and other musical sounds blared out. No wires linked Penn to the synthesizers making the sounds, yet the device sensed his every move.

When Rittmueller tried the gadget in the lab, its speed and three-dimensional awareness were "amazing," he recalls. If such a wireless-sensing system could be adapted to track an occupant of an automobile, he figured, he would be on his way to a superior airbag-controller that could determine the size and position of a passenger or driver and then judge whether it was dangerous to fire the airbag to its full extent.

On the spot, Rittmueller and the chair's designers started sketching possible airbag-related designs. Today, that collaboration between MIT and Rittmueller's Suwanee, Ga.–based automotive-electronics company, now called Elesys North America, is bearing its first fruit—an airbag controller that's already in some cars and soon to be introduced in many more.

The commercial use of the technology is expected to mushroom beyond the airbag niche, say developers of electric field imaging, the heart of the new technology.

"We're letting objects know what's around them," says Media Lab physicist Neil A. Gershenfeld. In this increasingly automated world, any technology that can do that reliably, cheaply, and autonomously could be useful in many places.

Taking charge

Imaging things in the world by means of electric fields actually started out as nature's own technology.

Several species of fish in South America and Africa generate and detect weak electric fields. Because small fish, larvae, and other prey perturb the electric fields around the field-generating fish, voltage-sensitive cells in their skin can detect the objects. Weakly electric fish, as they are called, also use electric signals to recognize and attract potential mates.

Electric field sensing has made it into the technoscape too. Anyone who has pushed one of those elevator buttons that responds to a finger's touch without itself moving has triggered an electric field sensor. A weak electric field continuously emanates from such buttons. When a finger contacts the button, that field becomes distorted. This causes an electric current increase in the button's circuit that's then interpreted by the elevator's control circuitry as, say, the "go to floor 10" command.

for the rest of the article, go to: http://www.sciencenews.org/articles/20040619/bob9.asp

Philips' fluid lenses bring things into focus

Royal Philips Electronics Press Information, March 3, 2004

(courtesy of Bill Vosteen)

At this year's CeBIT Exhibition in Hannover Germany, Philips Research is demonstrating a unique variable-focus lens system that has no mechanical moving parts. Suited to a wide range of optical imaging applications, including such things as digital cameras, camera phones, endoscopes, home security systems and optical storage drives, Philips' FluidFocus system mimics the action of the human eye using a fluid lens that alters its focal length by changing its shape. The new lens, which lends itself to high volume manufacturing, overcomes the fixed-focus disadvantages of many of today's low-cost imaging systems.

The Philips FluidFocus lens consists of two immiscible (non-mixing) fluids of different refractive index (optical properties), one an electrically conducting aqueous solution and the other an electrically non-conducting oil, contained in a short tube with transparent end caps. The internal surfaces of the tube wall and one of its end caps are coated with a hydrophobic (water-repellent) coating that causes the aqueous solution to form itself into a hemispherical mass at the opposite end of the tube, where it acts as a spherically curved lens.

The shape of the lens is adjusted by applying an electric field across the hydrophobic coating such that it becomes less hydrophobic – a process called 'electrowetting' that results from an electrically induced change in surface-tension. As a result of this change in surface-tension the

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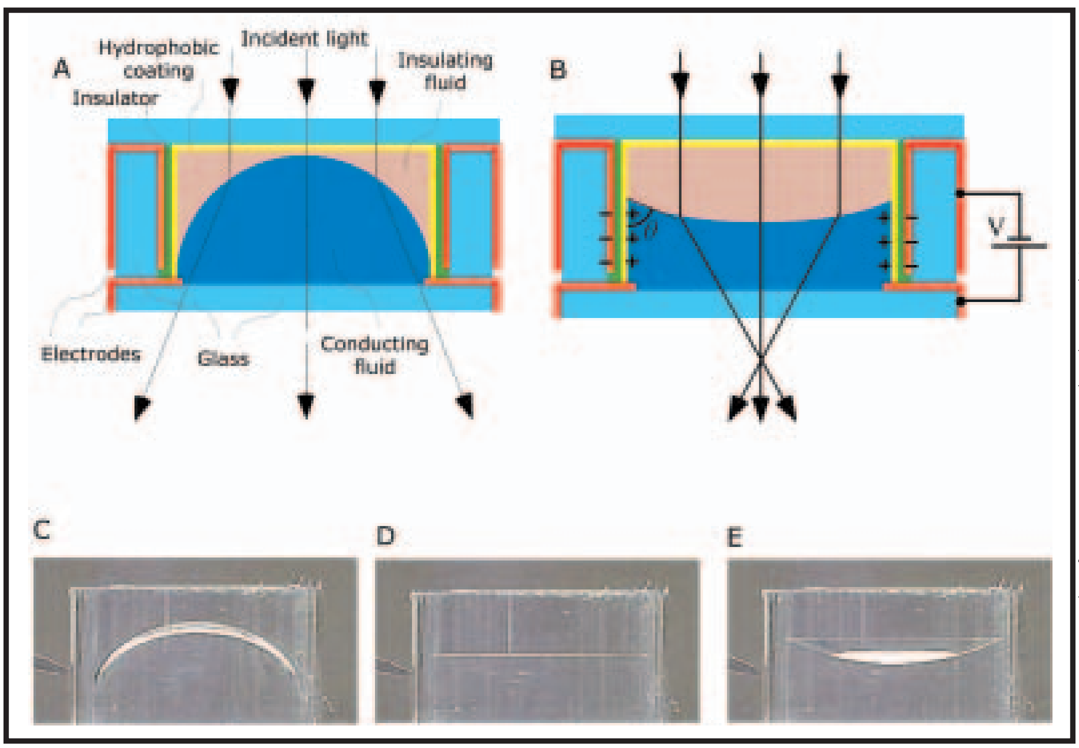

(A) Schematic cross section of the FluidFocus lens principle. (B) When a voltage is applied, charges accumulate in the glass wall electrode and opposite charges collect near the solid/liquid interface in the conducting liquid. The resulting electrostatic force lowers the solid/liquid interfacial tension and with that the contact angle ? and hence the focal distance of the lens. (C) to (E) Shapes of a 6-mm diameter lens taken at different applied voltages.

Bark Shrapnel

Tom Jones
University of Rochester

In May of this year (2004), Rochester endured a series of unusually heavy rain storms with some of the most intense lightning bombardments I have ever witnessed in this part of the country. Normally Rochester's thunderstorms are rather anemic - as least from the perspective of a Middle Westerner like me - but this spring was different. One Monday morning, I arrived at the University of Rochester campus to find a section of my parking lot blocked off by groundskeepers removing a tree that had been severely damaged by lightning the night before. It was a ~50 foot locust with a trunk diameter at the base of 12 to 14 inches. What interested me was a continuous strip of bark and wood blasted off the trunk from ground level to the very top. Pieces of this bark were scattered about over a 25 foot radius around the tree. The band of white wood revealed by the stripped bark made it easy to envision the path taken by the current. Because the tree was being cut down, there was no time to do any kind of inspection, but I did manage to gather a rather large piece of the bark and underlying woody layer (xylem), 36 inches long by about 10 inches around. On the specimen collected, there seemed to be NO evidence of burn marks, though there might have been some bits of fused material embedded in the bark. The woody layer, about 1/8 inch thick and very smooth (perhaps last year's growth ring), appears to have endured a massive tensile failure.

Now a tree's xylem remains moist with water transporting nutrients, minerals, and so forth up the tree by capillary action. The outermost portion of the xylem, near the living cambium, has the highest water content. Presumably, the electric current of the strike flash vaporized some of this water and the resulting over-pressure of steam led to the mechanical failure. (I tend to discount the JxB magnetic force as an alternate explanation, because this force is inward-directed, causing the well known z-pinch in plasma physics.) Many of us have seen old trees bearing obvious burn marks and scars from lightning strikes. But in this particular case, all that was to be seen was the bark and wood neatly stripped off. Perhaps, the high moisture content from the heavy rain prevented burning, though unfortunately for the locust tree the outcome was still fatal.

So now we seem to have a compelling new reason to avoid standing under a tree during a lightning storm, to wit, avoidance of the "shrapnel" of bark and wood blasted off the trunk of a wet tree during a strike. I would like to think this an example of superfluous but interesting information -- superfluous because we already know better than to stand under a tree during a storm. But there is always the risk that OSHA will institute a regulation that we start wearing safety goggles and flak jackets when tramping about the woods during lightning storms.

Franklin and Electrostatics: Ben Franklin as my Lab Partner

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Now available for free viewing and download on the website of the Dudley Wright Center for Innovative Science Teaching at Tufts University. The URL for the project is
http://www.tufts.edu/as/wright_center/fellows/bob_morse_04/index.html

My long interest in Franklin's work on electrostatics, sparked by Rodney LaBrecque's chapter on Franklin's experiments in my American Association of Physics Teachers workshop manual, Teaching About Electrostatics (AAPT 1992) led to a larger project on Franklin's experiments during a sabbatical at the Wright Center at Tufts University.

The result is a web publication of teaching materials in which Franklin's text is presented side by side with modern table top experiments using inexpensive materials. The downloadable package, available on the Wright Center website (see link above) has three components:

1. An extensive collection of Franklin's correspondence on electricity in PDF format transcribed primarily from Bigelow's 1904 edition of Franklin's work, with additions from Sparks 1837 edition. (two layouts- one for screen, one for print)

2. Nine sections of a laboratory guide to reproducing many of Franklin's experiments using inexpensive, modern materials. The experiments are suitable for individual use or for adaptation to classroom use. Four teacher workshops have been given using the draft editions of this project. The guide is illustrated by numerous reproductions of plates from older sources as well as drawings and picture s of the modern equipment, and includes historical commentary and citations.

3. A set of Quicktime™ movie clips supplements the sections, illustrating the techniques of constructing and using the equipment.

This project was supported by a fellowship from the Wright Center for Science Teaching, Tufts University, Medford MA, and by a sabbatical grant from St. Albans School, Washington, DC.

Current Events

(cont'd. from page 3)

aqueous solution begins to wet the sidewalls of the tube,altering the radius of curvature of the meniscus between the two fluids and hence the focal length of the lens. By increasing the applied electric field the surface of the initially convex lens can be made completely flat (no lens effect) or even concave. As a result it is possible to implement lenses that transition smoothly from being convergent to divergent and back again.

In the FluidFocus technology demonstrator being exhibited by Philips Research at CeBIT 2004, the fluid lens measures a mere 3 mm in diameter by 2.2 mm in length, making it easy to incorporate into miniature optical pathways. The focal range provided by the demonstrator extends from 5 cm to infinity and it is extremely fast: switching over the full focal range is obtained in less than 10 ms. Controlled by a dc voltage and presenting a capacitive load, the lens consumes virtually zero power, which for battery powered portable applications gives it a real advantage. The durability of the lens is also very high, Philips having already tested the lens with over 1 million focusing operations without loss of optical performance. It also has the potential to be both shock resistant and capable of operating over a wide temperature range, suiting it for mobile applications. Its construction is regarded as compatible with high-volume manufacturing techniques.

for more information, go to:
http://www.research.philips.com/InformationCenter/Global/FArticleDetail.asp?lArticleId=2919

Electrostatic Profiles

LOOKING FOR A FEW MORE BRAVE SOULS: Please take advantage of this opportunity to introduce yourself to the rest of the ESA members and help keep the friendliness growing. Please send your profile to me at *mark.zaretsky@kodak.com* .

Calendar

- 5th international Electro-Hydro-Dynamics Workshop, August 30-31, 2004, Poitiers, France, Contact: Hubert Romat, email: *hubert.romat@lea.univ-poitiers.fr* , website: http://labo.univ-poitiers.fr/informations-lea/EHD/p1.html
- 4th French Electrostatics Society (SFE) Congress, September 2-3, 2004, Poitiers, France, Contact: Gerard Touchard, email: *gerard.touchard@lea.univ-poitiers.fr*
- EOS/ESD Association 26th Annual Symposium, September 19-23, 2004, Grapevine Texas, email: *info@esda.org* , website: http://www.esda.org
- 6th-IEJ-ESA Joint Symposium, International Symposium on Electrostatics and Atmospheric Pressure Plasma Applications, Nov. 7-10, 2004, Tokyo, Japan, Contact: *oda@ee.t.u-tokyo.ac.jp* or *iesj@streamer.t.u-tokyo.ac.jp* , website: http://streamer.t.u-tokyo.ac.jp/~iesj/1stannounce.html
- Electrostatics 2005, June 15-17, 2005, Helsinki, Finland, Contact: *electrostatics2005@congreszon.fi* , website: http://electrostatics2005.vtt.fi/
- ESA 2005, June, 2005, University of Edmonton, Alberta, Canada. Contact: Angela Antoniu
- 15th IEEE Int'l. Conf. on Dielectric Liquids, June 26 - July 1, 2005, Coimbra, Portugal Contact: *electrostatics2005@congreszon.fi* , website: http://www-lip.fis.uc.pt/~icdl2005 **(NOTE: Abstracts due Oct. 15, 2004)**

Society News

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Executive Council:	Sheryl Barringer, Ohio State Univ.
	John Gagliardi, Rutgers Univ.
	Mark Zaretsky, Eastman Kodak

Email Addresses Requested

We would like to include member's current email addresses in our updated roster. Please send your current email address to me at *mark.zaretsky@kodak.com* . Also, please indicate if you would like to receive electronic notification of the newsletter (found on our website http://www.electrostatics.org) rather than a hard copy in the mail. Thank you for taking the time to send this information.

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