March/April 2004 • No. 169

ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

Our 2004 ESA Conference in Rochester, NY is coming quickly upon us. Please mark your calendars and make your plans to attend. Kelly Robinson is getting everything in order and we are expecting a great conference. The Rochester Institute of Technology campus is relatively new and I'm sure our accommodations will be quite nice. The tour of the RIT Center for Integrated Manufacturing, should be quite interesting. They are involved with a number of projects assisting a large range of industries.

My question posed in the last newsletter regarding cell phones as an ignition source brought some interesting responses from our membership. What started this was a page from "Fire Police News" or V.F.P.A.S.N.Y. titled "Danger! Gas Stations & Cell Phone Dangerous Mix", which I found on our bulletin board here at Monroe Electronics. The summary of this page is that Shell Oil Company had issued a warning after three incidents in which mobile phones (cell phones) ignited fumes during fueling operations. The page goes on to discuss the dangers of both cell phone and static ignition problems at gas stations. Upon reading this and thinking about it, I couldn't think of what the ignition mechanism would be from a cell phone, prompting my question. Ruth Douglas Miller, Carlton Speck and Gerald W. Boicourt all responded stating that this is an urban legend and that these official looking notices are a hoax. There have been instances where there was an ignition with a cell phone present but upon further analysis, in all cases, static electricity appears to have been the culprit and not the cell phone itself.

I did a quick search with Google on this subject and found some very good information on this subject. If you want to see what prompted my questions, go to: *http://www.trendmicro.com/vinfo/hoaxes/hoax5.asp?HName=Cell+Phone+Ignition+Hoax* . There you'll find the text of the page I referred to above. I also found a document titled "Cell phone usage at gasoline stations", done by Exponent Failure Analysis Associates for the Motorola Corporation at: *http://www.exponent.com/about/docs/CellPhoneReport.pdf* . This analyzes cell phones as ignition sources at gasoline stations and again debunks the whole notion. Again, from what I have read, there is not one case of gasoline ignition that, with complete certainty, can be blamed on a cell phone.

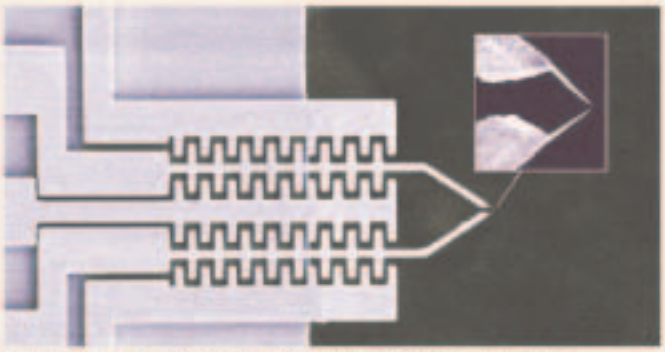
This just reinforces the need to be very discriminating regarding your sources of information in this day and age.

See you at RIT at the conference.

Bill Vosteen
ESA President

2004 ESA Annual Meeting - June 23-25, 2004
Rochester Institute of Technology (RIT)
Rochester, NY

(registration form inside)



Handy in a pinch: the Nanohand is a silicon set of tweezers for picking up nanometer-scale objects. Electrostatic forces caused by voltages at five electrodes open and close the tweezers. Gold extensions (inset) decrease the gap between the tips to just 100 nm, and gaps as small as 25 nm have been produced.

Danes Forge Nanotools

A robotic hand can pick up, move, and solder nanometer-scale components

Peter Boggild is making a toolbox—one with very small tools. As leader of the Nanohand project at Mikroelektronik Centret (MIC) in the Technical University of Denmark (Lyngby), he has directed the construction of a pair of tweezers that can pick up and move nanoparticles and a soldering device that can fasten them to just about anything. "[It's] similar to the tools used in making electronics in a workshop," he says. The Nanohand could be used to build experimental nanometer-scale research devices, such as transistors made with semiconducting nanowires. But Boggild's goal is more fundamental. "We're taking the concept of the hand as a basic human tool and shrinking it down, he says. "We want to know how far it can go."

The Nanohand starts as a pair of silicon microcantilevers that hang over the edge of a microchip, built using standard silicon processing (see micrograph). Adjusting the voltages on a set of five electrodes electrostatically opens them as wide as 700 nm or closes them. But the best one could do working only with silicon was not quite fine-fingered enough. To make the tweezers hold something of nanometer size, the MIC group had to find a way to add nanoscale prongs to the tweezer tips. The Nanohand was put inside an electron microscope, whose chamber contains a gold- and carbon-based gas. Focusing the microscope's electron beam on a tweezer tip and then slowly sweeping the focal point in toward the other tip catalyzes a reaction in the gas and literally draws a solid wire of carbon-encrusted gold along the focal point's path (see inset). Doing the same with the other tip produces tweezers that, at rest, have a gap as small as 25 nm.

Boggild likens the elongated tips on the Nanohand to fingernails. The device can easily pick up and manipulate silicon wires 100 nm thick, and Boggild says the group will go for 10 nm this summer.

The same electron beam technique that draws the fingernails can also solder things—a handy trick when building nanodevices. The electron beam is focused on the spot to be soldered, and the gold-carbon gas mix reacts to form a solder joint, this time of pure gold.

Boggild and his colleagues have soldered carbon nanotubes across the tweezers' tips and stretched them to study their electromechanical properties. The hope is that nanotubes will make good force sensors, since their electrical properties change when they are stretched. In the end, Boggild would like to use one Nanohand to solder such sensors between the moving parts of another, and then use the sensor output to provide a sense of touch to the hand's user. —Samuel K. Moore

from IEEE Spectrum, July 2003

Turning Cellulose Waste Into Nanofibre

It may soon be possible to produce a low cost, high-value, high-strength fiber from a biodegradable and renewable waste product for air filtration, water filtration and agricultural nanotechnology, report polymer scientists at Cornell University. The achievement is the result of using the recently perfected technique of electrospinning to spin nanofibers from cellulose.

"Although researchers have predicted that fibers with strength approaching Kevlar could be made from this fiber, no one has yet achieved this. We have developed some new solvents for cellulose, which have allowed us to produce fibers using the technique known as electrospinning," says Margaret Frey, an assistant professor of textiles and apparel at Cornell.

The technique of electrospinning cellulose on the nanoscale was successfully used for the first time a few months ago. It involves dissolving cellulose in a solvent, squeezing the liquid polymer solution through a tiny pinhole and applying a high voltage to the pinhole. "The technique relies on electrical rather than mechanical forces to form fibers. Thus, special properties are required of polymer solutions for electrospinning, including the ability to carry electrical charges," says Frey.

The charge pulls the polymer solution through the air into a tiny fiber, which is collected on an electrical ground, explains Frey. "The fiber produced is less than 100 nanometers in diameter, which is 1,000 times smaller than in conventional spinning," she says.

The new technique is now possible because of a new group of solvents that can dissolve cellulose, Frey says. The Cornell researchers currently are using experimental solvents to find one that will produce fibers with superior properties.

Whenever cotton is converted to fabric and garments, fiber (cellulose) is lost to scrap or waste. At present it is largely discarded or used for low-value products, such as cotton balls, yarns and cotton batting.

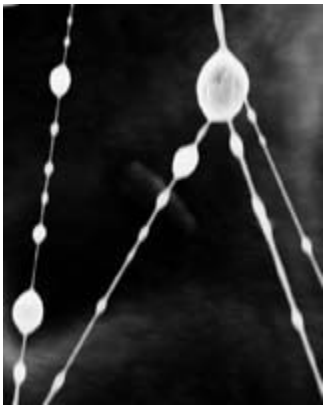
"Producing a high-performance material from reclaimed cellulose material will increase motivation to recycle these materials at all phases of textile production and remove them from the waste stream," notes Frey. She says that electrospinning typically produces nonwoven mats of nanofibers, which could provide nanoscale pores for industrial filters.

"Producing ultra-small diameter fibers from cellulose could have a wide variety of applications that would exploit the enormous surface area of nonwoven mats of nanofibers and the possibility of controlling the molecular orientation and crystalline structures of nanoscale fibers," says Frey.

If successful, possible applications might include air filtration, protective clothing, agricultural nanotechnology and biodegradable nanocomposites.

"Another application we foresee is using the biodegradable electrospun cellulose mats to absorb fertilizers, pes-

ticides and other materials. These materials would then release the materials at a desired time and location, allowing targeted application," says Joo.



Scanning electron microscopy (SEM) micrograph of electrospun cellulose fibers. Cornell image.

for more info. http://www.spacedaily.com/images/nanotech-cornell-fibres-bg.jpg

A pressure-driven battery

excerpted from The Industrial Physicist, Feb./March 2004

A Canadian engineering team at the University of Alberta (Edmonton) has invented a new method for generating electricity on a small scale from kinetic energy without using turbines or other moving parts (J. Micromech. Microeng. 2003, 13, 963). The new approach, termed an electrokinetic microchannel battery, makes use of electric double layers, a phenomenon that occurs in a conducting liquid (such as saltwater) very near a solid surface.

An electric double layer forms because many insulators, such as glasses and ceramics, have an excess of electrons on their surface. This excess attracts positively charged ions in the water, creating a thin, positively charged layer. When the water moves under pressure through a channel, the ions tend to pile up at the downstream end of the channel, while the electrons, trapped in an insulator, cannot follow them. The result is a small positive potential between the downstream and upstream ends of the channel. If these ends are connected by a conductor, a small current flows, which converts the kinetic energy of the water flow into electricity, without moving parts. (Magnetohydrodynamic conversion can do the same thing, but it requires an imposed magnetic field.)

Because the ions are confined to a thin layer—generally on the order of 1 μm—significant conversion of kinetic to electric energy occurs only when there is a large ratio of the surface area of the flow to its volume. This occurs when the fluid is forced through the microchannels of a porous material. Using a commercial porous glass filter 20 mm in diameter, and with a pore size from 10 to 16 μm, the team produced a 1.5-μA current using tap water and a 30-cm pressure head. "In more recent experiments, we have achieved a 1% conversion efficiency," explains team leader Daniel Y. Kwok of the university's department of mechanical engineering. "We are not trying hard yet to maximize efficiency. We are still in the proof-of-principle phase." Kwok says that the battery's main advantages are its complete lack of environmentally polluting materials and moving parts.

A major disadvantage is that the battery stores energy in the form of pressurized water, so applications could not require very high energy-storage densities. Even at 100 atm, water would have only one-sixteenth the energy density of a nickel–cadmium battery.

for more information http://www.tipmagazine.com/tip/INPHFA/vol-10/iss-1/p10.html

ShockRounds™ - Electric Bullets

ShockRounds™ are positioned to be a potential major breakthrough product for the law enforcement industry, the military and border control and anti terrorism initiatives. ShockRounds™ are specialized bullets and/or non-lethal munitions that generate a high voltage charge and are fully compatible with standard ammunition calibers. This voltage discharges upon impact causing immediate target incapacitation. ShockRounds™ use what is known as the "piezoelectric effect" to generate a high voltage charge. This is accomplished with PZT Ceramic crystals.

ShockRounds™ require a certain degree of momentum in order to actuate their electric charge, but, unlike all currently existing alternative rounds, they do not rely primarily on high velocity kinetics for their effects. Instead, the ShockRounds™ bullets are designed to discharge voltage sufficient to cause behavior modification, and they need only modest impact to discharge the voltage. Because of this property, they avoid producing the type of trauma that current kinetic rubber bullets often produce.

ShockRounds™ provides an additional incapacitation mechanism to standard physical trauma and wound channel effects. The high voltage pulse delivered to the nervous system of the individual causes a temporary "shutdown" of voluntary neurological activity, enabling the authorities the opportunity to subdue the subject before he revives. There is a considerable body of evidence in stun gun and electric fence studies indicating that incapacitating voltages can be delivered with minimal or no long-term effects.

for more information http://www.shockrounds.com/shock/p2.html

Current Events

Bad Hair Day
from Globe and Mail
(courtesy of Peter Castle)

"Last week (*way back in Dec., 03 - ed.*), a hair stylist in Georgia was pumping gas into her vehicle when her hair burst into flames. "That scared me to death", said Traci Marshall. The fire was probably caused by static electricity from Ms. Marshall's hair rubbing against her clothes, said her husband, firefighter Bill Marshall. He advises people to ground themselves before pumping gas, by touching the metal of their cars. "Once you are out of your vehicle, don't get back (in) until you are through." Ms. Marshall had to cut her hair and get her truck repaired."

Sources & Sinks

Electrostatics of Mylar Balloons

An interesting incident reported by someone who inquired via our website. Want to share your theories? Send them to me, Mark Horenstein, at : *mnh@bu.edu* and I will pass them on to Scott.

Dear ESA,

Last night, I brought home a Mylar balloon (inflated) for my daughter's birthday party. I had to hide it inside my nylon coat, and when I went to pull it out, I think I experienced a pretty hefty shock that seemed to concentrate on my head. I am still feeling the effects some 24 hours later, especially in my ears and teeth. I don't think it has affected my hearing at all, but I was wondering just how much electricity/static a Mylar balloon can create, and if it is potentially dangerous. It was in my coat for only a minute while I snuck it upstairs, and the outside temperature was in the 20's (F) last night when I stuck it in my coat. The balloon does have a warning on it about conducting electricity.

The coat's shell and lining are 100% nylon, with 100% polyester knit trim. I was wearing tennis shoes with rubber soles, but the soles have holes in them and collected water/snow. I had walked across carpeting and up carpeted stairs. The balloon is shiny and has a warning on it about the possibility of conducting electricity.

Just to clarify, the static charge I received had an extended crackling sound, along with the jolt I received. And you can bet I'll never put a mylar balloon under my coat again, especially with wet sneakers!

Thank you for your help.

Scott Stocking

Paxton, IL

Society News

ESA Officers

President:	William Vosteen, Monroe Electronics
Vice President:	Kelly Robinson, Eastman Kodak
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.

Electrostatic Profiles

Professor Stuart Hoenig, University of Arizona

I have been a Professor of Electrical and Computer Engineering for 29 years at the Univ. of Arizona. I am now partially retired but still active at things like the electrostatic system for removing water vapor from air. I am in the process of talking to companies that might manufacture and sell it.

I also do some things with the Dept. of Agriculture and Biosystems. Typically new systems for saving water or getting fresh water from sea water at reasonable cost.

I do have a question - is it of any interest to the Society that fires are charged and always +? This is true for wood, charcoal, propane etc. Under the circumstances it would seem that water sprays used on fires should be charged negatively, this was tested by the Navy and found to work, but they screwed up the tests so badly that nothing more was done.

In rural areas they are often short of water for fire fighting. The charging would insure that the water goes to the fire, not elsewhere. I have designed some nozzles that keep the operator safe even when the water is charged.

Looks like a good area for some manufacturer.

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* .

Electrostatics Society of America

ESA 2004 Registration Form

June 23-25, 2004
Rochester Institute of Technology
Rochester, New York

Mail or Fax Form to:

Kelly Robinson
Eastman Kodak Company
1669 Lake Avenue
Bldg. 23 Rm. 364
Rochester, NY 14652-4317
Fax: 585-477-1151

Tel: 585-477-4951
Email: Kelly.Robinson@Kodak.com

Note: You also can register online at www.electrostatics.org

Date: _____

Name: _____ Name on Badge: _____

Affiliation: _____

Address: _____

City: _____ State: _____ Zip: _____

Email: _____

Phone: _____ Fax: _____

Conference Registration Fees

Full Conference registration fee – ESA Members includes Tuesday welcome reception, Thursday banquet, meals from Wednesday breakfast thru Friday lunch, and conference proceedings	by 5/21/04	$195	$
	after 5/21/04	$220	
Full Conference registration fee – Non-Members includes all the above and a one year ESA membership	by 5/21/04	$215	
	after 5/21/04	$240	

Banquet meal: ☐ Beef ☐ Chicken ☐ Vegetarian

Single Day Registration member or non-member includes conference proceedings & snacks at breaks. No meals included.		$50	$
Extra Copies of Conference Proceedings	#	@ $30	$
Extra Banquet Tickets ☐ # Beef ☐ # Chicken ☐ # Vegetarian		@ $25	$
		TOTAL	$

Accommodations

Arrival Date:	Departure Date:
Approximate Arrival Time:	Approximate Departure Time:

1. RIT Student Apartment, 4 bedroom, shared bath ☐ Female ☐ Male (for apartment assignments only)	per person, per night	$26.00	$
	linen charge (1 time fee)	$15.90	$
	Registration required by 5/21/04.		

2. RIT Inn and Conference Center (hotel w/ restaurant) free shuttle service to campus	**$75 per room, per night** Call: 585-359-1800 – Mention the "ESA" for this room rate.
3. Radisson Inn (hotel w/ restaurant) free shuttle service to campus	**$119 per room, per night** Call: 585-475-1910 – Mention the "ESA" for this room rate. Book room by 5/28/04 to guarantee availability

Conference Tour

I am interested in the Friday afternoon tour of the Rochester Institute of Technology Center for Integrated Manufacturing (no additional fee)	YES	
	NO	

Payment

	I have enclosed an international money order or check in $US drawn on a US bank, made out to **"Electrostatics Society of America"**
	I will pay on-line using Pay-Pal (www.electrostatics.org).

Electrostatics Society of America

30 Shalimar Drive
Rochester, NY 14618

Current Events Calendar

- ESA 2004, June 23-25, 2004, Rochester, NY, Contact: Kelly Robinson, email: *kelly.robinson@kodak.com* , website: *http://www.electrostatics.org/Announcements/2004%20Call-For-Papers.htm*
- 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* **(NOTE: abstracts due April 30, 2004)**
- 4th French Electrostatics Society (SFE) Congress, September 2-3, 2004, Poitiers, France, Contact: Gerard Touchard, email: *gerard.touchard@lea.univ-poitiers.fr* **(NOTE: abstracts due April 30, 2004)**
- EOS/ESD Association 26th Annual Symposium, September 19-23, 2004, Grapevine Texas, email: *info@esda.org* , website: *http://www.esda.org* **(NOTE: abstracts due April 30, 2004)**
- Electrostatics 2005, June 15-17, 2005, Helsinki, Finland, Contact: *electrostatics2005@congreszon.fi* , website: *http://electrostatics2005.vtt.fi/* **(NOTE: second call for papers - abstracts due May 28, 2004)**

ESA Information

ESA Home Page: *http://www.electrostatics.org*

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