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ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

This is my first message that doesn't contain some administrative content. I have taken some time to reflect on ESA as a whole, which I'm sure every ESA president has done before me. I'm rather awed by the scope of the realm of electrostatics and our broad base of membership. It seems like any area of creation we can observe has some aspect that is affected by electrostatics in some way. There also isn't anyone on the planet that hasn't marveled at some expression of electrostatics, from a child (or adult) playing with charged balloons or watching lightning, to the scientist observing some finer aspect of creation, and most everyone in between.

We are very inclusive, able to structure our organization to accomodate everyone who is interested in joining and yet we are very exclusive, as there are only a few of us who place enough interest in (and importance upon) electrostatics to join an organization like ESA.

At first I was daunted to address such an eclectic group as most of our areas of personal interest in electrostatics is shared by a small segment of our organization. However, understanding the broad areas of interest of our membership as a whole, I realize that most anything goes.

Enough rambling, I do want to ask you if there is anything you want me to address in this column or look into as president of ESA, please let me know. I hope everyone has had a good summer.

For the Friendly Society,

Bill Vosteen
ESA President

Editor's Follow-up

I'd like to take this opportunity to follow-up on one or two critical issues that Bill raises in his message.

We are a diverse group, yet there is a commonality that draws us together. The initial nucleus of the society when it was formed in 1970 involved folks from areas such as atmospheric electrostatics, xerography/electrophotography, electrostatic paint spraying, electrostatic flocking. Electrostatically charged droplets or particles seem to be at least one underlying theme that united (dare I say precipitated) these early pioneers of the ESA.

What about the present? What unites us in the ESA of the early 21st century? What are the common themes for our present membership?

Is it still the same traditional electrostatics that motivated our founders? Is it the utilization of electrostatic forces in MEMS and nanotechnology? How about electrostatics in understanding biological processes?

I find myself interested in many of these applications of electrostatics, and others, though it is difficult to keep up with these advances. I believe the ESA is one way for me to keep learning about these new developments, and do so in a manner that I find very enjoyable, within the confines (though not confining) of the "Friendly Society".

What are you looking for as a member of the ESA? Is the ESA fulfilling your needs? Are there areas of interest not being covered? Please let us know - this is your society, your newsletter. My obligation is to produce a timely newsletter that meets the membership needs. Your obligation is to help identify those needs. Thanks.

Mark Zaretsky
Newsletter Editor

Current Events

Underwater Electric Barriers

(thanks to a tip from Mark Horenstein)

Usually high voltage and salt water don't make for good companions. However, did you know there is a whole industry utilizing electric fields for underwater applications?

There are devices called electrofishers used to stun and collect fish. Models vary in voltage/current levels, waveform (AC/DC/pulsed) and are selected based upon the conductivity of the water.

Electric barriers use pulsed DC to prevent fish from entering water regions for a variety of reasons such as maintenance of industrial sites or preservation of ecologically fragile systems.

for more info. google search on electric barriers or check
http://www.smith-root.com/products/
http://chicagowildernessmag.org/issues/spring2003/news/electricbarrier.html
http://www.seagrant.wisc.edu/outreach/nis/Barrier/Construct.asp

Patent Awarded for Method of Making Nanobatteries

(courtesy of Matti Murtomaa)

A University of Tulsa chemistry professor and two former students have been awarded a patent for a method of making nanobatteries for use in tiny machines similar to the microbe-size craft that traveled through a human's blood vessels in the 1966 science-fiction movie, "Fantastic Voyage."

U.S. Patent 6,586,133 was awarded July 1, 2003, to chemistry professor Dale Teeters and to Nina Korzhova and Lane Fisher, who were both chemical engineering students at TU when they worked on the process to manufacture nanoscale microscopic batteries. One nanometer is one-billionth of a meter. The diameter of an average hair is 50,000 nanometers. The invention is a manufacturing process that can build, charge and test nanobatteries.

So far Teeters and his researchers have made batteries that are so small that more than 40 could be stacked across the width of a hair -- and they continue to make even smaller batteries.

The method includes use of a porous membrane, filling the pores with an electrolyte, and capping the pores with electrodes. Conventional batteries have two electrodes that deliver the charge and an electrolyte through which charged ions move.

The manufacturing process begins with an aluminum sheet that is placed in acid solution under an electric current, resulting in an aluminum oxide membrane. When the metal is dissolved, a honeycomb structure results. The pores are then filled with an electrolyte -- comparable to the liquid in a car battery -- which in this case, is a plastic-like polymer. Next the filled pores are capped on both sides with electrodes -- ceramic or carbon particles -- similar in function to a car battery's lead plates and two posts.

Key tools in the process are a scanning electron microscope and an atomic force microscope, which can observe and manipulate particles as small as molecules -- and is used to charge the microscopic array of batteries. Each battery packs as much as 3.5 volts. The microscope's custom-made electrically-conducting cantilever tip is touched to the electrode so that the battery can be charged and tested.

excerpted from
http://www.newswise.com/articles/view/?id=500572

Protective Outerwear

Most of the time we think of protective outerwear in terms of providing ESD protection by preventing charge build-up.

Think again!! Here is protective outerwear designed to deliver high voltage shocks (80kV from a 9V battery) and provide human protection.

"According to the Senate Judiciary Committee, three out of four women in the United States will be victims of one violent crime during their lifetime.

The No-Contact Jacket is a wearable defensive jacket created to aid women in their struggle for protection from violence. When activated by the wearer, 80,000 volts of low amperage electric current pulses just below the surface shell of the entire jacket. This exo-electric armor prevents any person from unauthorized contact with the wearer's body.

If an assailant were to grab hold of the wearer the high voltage shocking exterior would interrupt their neurological impulses which control voluntary muscle movement. The neuromuscular system would be overwhelmed causing disorientation and loss of balance to occur and of course pain. The pain experienced is non-lethal but is enough of a shock to effectively and immediately deter contact with her body and provide a critical life saving option for escape."

for more information http://www.no-contact.com/index.html

CALL FOR PAPERS

2004 Electrostatics Society of America Annual Meeting
June 23-25, 2004
Rochester, New York USA

The 2004 Electrostatics Society of America (ESA) Annual Conference will be held in Rochester, New York from June 23 25, 2004. Join us for our technical sessions including comprehensive technical papers, a Student Paper Competition, informal discussions, poster sessions, and electrostatics demonstrations.

TOPICS OF INTEREST INCLUDE:

- Atmospheric Electricity
- Biological Applications
- BioMEMS and BioFluidics
- Breakdown and Discharges
- Charge Neutralization
- Computational Methods
- Display Devices
- Electrets
- Electrohydrodynamics
- Electrophotography
- Electrostatic effects in drug delivery
- Electrostatic Painting
- Electrostatic Powder Coating
- Electrostatic microencapsulation
- Electrophoresis
- Electroviscous effects
- Electrostatic Printing
- Electrostatic Propulsion
- Electrostatics Demonstrations
- Electrostatics Education
- ESD Prevention/Detection
- MEMS Devices
- Nonthermal Plasmas
- Nanoelectrospray applications
- Particle Control & Transport
- Precipitators and Cleaners
- Safety and Hazards
- Sprays and Droplets
- Triboelectrification

DEADLINES:

February 25, 2004	**Titles, abstracts and name of 1 - 2 relevant subject area from the list above are due to** *http://www.electrostatics.org*
Mid - February	**Registration and detailed conference information will be available at** *http://www.electrostatics.org*
March 5, 2004	**Notification of Paper Acceptance**
April 15, 2004	**Final Manuscripts Due. Instructions for authors are available at** *http://www.electrostatics.org*, **along with templates for MS Word and Latex.**

Authors may request that their manuscript be considered for publication in the Journal of Electrostatics.

STUDENT PAPER COMPETITION:
To encourage participation by student researchers, all presentations (either in the main session or poster session) that have a student as the presenter and first author will be considered for the student paper competition. Undergraduate and graduate students are eligible. Papers will be judged on their technical merit and the cogency of their presentation. Please indicate at submission that the abstract is to be considered for the student paper competition, and list all student authors.

Contact the General Chair for information regarding transportation and accommodations, or the Technical Chair for information regarding the technical sessions:

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Electrostatic Profiles

Kelly Robinson

I first learned about electrostatic phenomena and technologies when I took the Junior level electromagnetics course. This was very interesting to me and led to my PhD work with Prof. Tom Jones at Colorado State University on the electrical currents and forces in beds of semi-insulating particles.

I have had three different jobs at the Eastman Kodak Company. I began working as a bench scientist working on copier toning technology learning about charged toners, magnetic fields, and particle adhesion. Next, I worked as a Group Leader (informal leader) working on electrostatics in media manufacturing, primarily photographic film and paper learning about surface charge on webs, discharges, ionizers, tinsel, and sheet sticking. And, I served as the Unit Director (Lab Head) of the Surface Modification and Electrostatics Unit learning about business strategy, budgeting, and aligning efforts with corporate initiatives. I had a little time to learn about corona discharge treatment, plasma discharges, and vacuum coating technology.

One of the great things about working for a company as large and diverse as Eastman Kodak is that there are a large variety of operations including chemical production, wide-roll manufacturing, electronic assembly, packaging, and working with customers who use our products. Electrostatic phenomena are ubiquitous; occasionally beneficial, often not, and always interesting.

I look forward to welcoming you to Rochester for our 2004 meeting. We will have fine facilities, including air-conditioned dormitory rooms. Prof. Sheryl Barringer, our Technical Program Chair, is assembling an excellent technical program and Prof. Ned Greene is organizing a Student Paper Competition. I hope to see you in Rochester next June.

Glenn Schmeig

Early Life
I grew up in Detroit where my father worked in the area of industrial dust collection. He installed machines at General Motors that washed factory air with water. I remember at an early age that he told me about a competing process that used electrostatic precipitation. I was far too young to understand any details, but I knew that my father's patented machines treated fumes and the ES machines treated particles.

Education
In high school and beyond, I loved chemistry and math. At the University of Michigan I combed the catalog and discovered that of all the degree programs, the one which allowed the most electives was mathematical engineering - so I chose it.

Special Likes
Two of my great joys are movies and being outdoors in the woods. When I am in the city I often see three movies per week. When I travel to my cabin in the woods of Michigan, I enjoy the wildlife and being a bit primitive. My cabin has no running water, no electricity, and no phone. Even cell phones don't work. It's not close to any cities.

Other likes include shooting pool, large dogs, and reading almost any non-fiction.

Dislikes
World news, all politicians, television, and anyone who doesn't laugh at themself.

Radical Idea
I believe that all drug laws should be discarded. Every free citizen should be able to buy whatever chemicals they wish. I include not only heroin and morphine, but all drugs used by medical practitioners. There should be no prescriptions in a free country.

Best ESA Feature
The fabulous friends I enjoy each June.

Current Events

Spin and Energy - Free?

(follow-up from an item in the previous issue)

Your news brief reported on an experiment that appears to violate the law of conservation of energy and also questions the validity of electrostatics as we know it. Let me try to salvage both energy conservation and electrostatics by offering a more mundane mechanism for the phenomenon described (1). First, let us recall why, in any configuration of external charges, the static electric field cannot produce a torque required to spin a metal sphere about its center. The density of electrostatic force per unit of surface is σE, where σ is the surface charge density and E is the electric field. The density of torque, correspondingly, is $\sigma[ExR]$. If there is no surface current, the electric field, E, has only normal component parallel to the radius-vector R, and, therefore, the density of torque is zero everywhere on the surface of the sphere. In order to have nonzero density of torque and, correspondingly, a possibility of nonzero net torque, there must be the surface current. Then, tangential to the surface component of the field E_t, there may result the net torque τ, given by $\tau = \int\sigma[E_t xR]$ *df*. Incidentally, the requirement that the constant torque must be accompanied by the persistent surface currents saves from extinction the energy conservation law. The spinning of an object requires a certain amount of electric power to be converted into mechanical work to compensate for inevitable friction. This is possible only when the current is drawn from the power source.

What is the nature of current? Since the authors report that there was no sparking between the conductors, the only option is a low-intensity corona discharge. The potential difference of 400 to 5,000 V and a surface-to-surface separation of about 5 mm are sufficient for initiation of the corona. The mechanism of the appearance of the net torque in the three-spheres configuration is shown in the figure. Sphere 2 is fixed, and let us take it as positively charged. Spheres 1 and 3 are free to rotate, and both are negatively charged. The discharge is mainly confined between spheres 2 and 3 (red region). The presence of sphere 1 shifts the ionized cloud somewhat off the line connecting the centers of spheres 2 and 3. The surface current flowing out of the zone of discharge and the respective tangential component of the electric field create the net torque indicated by the arrow. Without sphere 1, the distribution of current and field would be symmetric and result in zero net torque. It would require too much hand-waving to try to explain the direction of rotation of sphere 1 on the basis of forces. It will suffice to invoke angular momentum conservation, since the angular momentum of the discharge current is negligible.

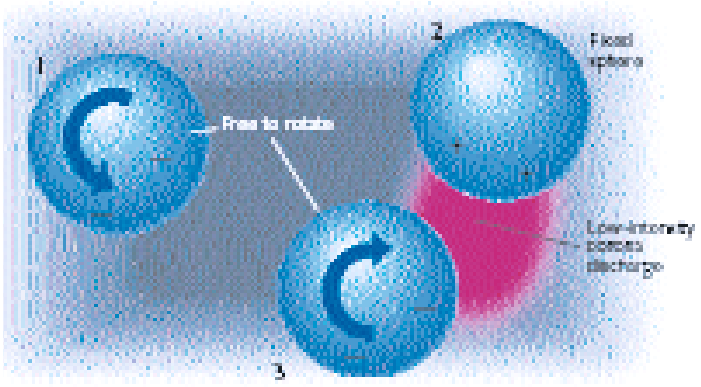
Finally, I want to emphasize strongly that, even though it is not immediately apparent from the treatment just given, the necessary condition for conversion of electric energy into mechanical energy is the hysteretic nature of the discharge. Namely, the discharge current can be maintained in the electric field lower than that required for its initiation. Further analysis of the three-sphere configuration is not particularly interesting because, apparently, this is an accidental arrangement and does not efficiently utilize the outlined effect.

George A. Levin
Propulsion Directorate, Superconductivity Group
Wright-Patterson Air Force Base, Ohio

Reference

1. Wistrom, A. O.; Khachatourian, A. V. M. Appl. Phys. Lett. 2002, 80, 2800.

This was pulled from the Oct./Nov. 2003 issue of The Industrial Physicist. A response from A.O. Wistrom was not reproduced here due to lack of space. You may find it in the afore-mentioned journal or at http://www.aip.org/tip/INPHFA/vol-9/iss-5/p23.html



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.

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