Jan/Feb 2011 • No. 206

ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

Chocolates and Electrostatics

Dear ESA Members:

By now those of you who submitted the abstracts for 2011 ESA meeting have received your acceptance and are busy preparing the paper. A glance at the 59 abstracts (including 5 keynote/invited talks) indicates, as usual, the wide range of applications for electrostatics. Chocolates/snacks/eatables are no exception to this, as charged particles do not distinguish between chocolate or a car surface and will coat wherever we apply an appropriate electric field. The coating of chocolates using EHD spraying is addressed by our ESA specialist on snacks from Ohio University. The abstract from University of Georgia addresses food handling surface sterilization using electrostatically deposited antimicrobial sprays. In a previous issue we have seen electrospinning of polymers for food package applications by the group from University of Waterloo, Canada. This time they are talking about the theory behind the physical mechanisms of electrospinning. It will be quite exciting to listen to the presentations of these researchers, as food quality (taste) is strongly influenced by the coating [1]. Additionally, the coating also affects shelf life, forming a protective barrier to maintain desired characteristics such as the crispness of a cookie. The spraying, transport and adhesion of a coating, such as the seasoning of banana chips [2], encompasses surface physics and particle dynamics, in addition to the relevance of the charge polarity, as discussed in positive vs. negative electrostatic coating using food powders (Sumawi and Barringer [3]). They find that electrostatic coating of various seasonings (including barbeque, sour cream and onion, salt and paprika) were preferred as compared to non-electrostatic coatings due to their more uniform coating and higher flavor intensity [2]. In addition, an electrostatic coating significantly improved the coating efficiency (61%) and reduced dust (54%). Salt exhibited the maximum improvement, followed by sour cream/onion and then barbeque. The electrostatically coated seasoned, fried banana chips had better quality and reduced cost. What more can we ask from our electrostatic phenomena?

Enjoy your electrostatic and other research/work.

As usual I look forward to hearing from you. I am very glad to mention that I got the most positive comment from one of our esteemed ESA friends about the last message on Leadership & ESA, and I can't thank them enough.

Very Many Thanks. Have a great time.

Yours for the friendly Society,

Raji Sundararajan,
ESA President

References:

[1] M.K.I. Khan, "Electrostatic coating of foods", http://www.fbe.wur.nl/UK/Research/Separation+and+Particle+Technology/Electrospray+coating+of+foods/ .

[2] P. Ratanatriwong, S. Suwansri, S.A. Barringer, and P. Tanasukara, "Effect of electrostatic coating on consumer acceptance and process efficiency of seasoned coated snacks", Asian J. of Agro-Industry, 2(01), 51-64, 2009.

[3] H. Sumawi and S.A. Barringer, "Positive vs. negative electrostatic coating using food powders", J. of Electrostatics, 63, 815-821, 2005.

In Memoriam

Remembering Professor Jen-Shih Chang

David S. Wilkinson, March 2, 2011

It is with sadness that we inform the McMaster community of the passing of Jen-Shih Chang, professor emeritus in the Faculty of Engineering.

Jen-Shih Chang joined the Department of Engineering Physics as an assistant professor in July 1979 and was promoted to professor in July 1987. He taught and conducted research in environmental and energy-related technologies. He was recognized internationally for his research expertise, and continued his highly productive endeavors even after his retirement in July 2005.

Throughout his time at McMaster, Jen-Shih was a prolific supervisor and his students have gone on to successful careers in industry, government and academia. He was a dynamic and cheerful person and will be greatly missed by his colleagues and many students.

(for more info. on Professor Jen-Shih Chang, start with this link to McMaster Univ. http://engphys.mcmaster.ca/faculty_staff/faculty/chang/index.htm)

Calendar

- ESA-2011, June 14-16, 2011, Case Western Univ., Cleveland, OH Contact: Dan Lacks, *daniel.lacks@case.edu,* website: http://www.electrostatics.org
- IEEE-IAS Annual Meeting, Electrostatic Processes Committee, Oct. 9-13, 2011, Orlando, FL, Contact: Lucien Dascalescu, *lucian.dascalescu@univ-poitiers.fr.* , website: *http://ewh.ieee.org/soc/ias/2011/home.htm*
- 2nd ISNPEDADMSA (New electrical tech. for environment), Nov. 14-19, 2011, Noumea, New Caledonia, Contact: Gerard Touchard, *gerard.touchard@univ-poitiers.fr,* website: http://lea.sp2mi.univ-poitiers.fr/noumeameeting/ (abstracts due April 30th)

ESA OFFICERS

President:

Rajeswari Sundararajan, Purdue Univ.

Vice President:

Dan Lacks, Case Western Reserve Univ.

Executive Council

Sheryl Barringer, Ohio State Univ.
Steve Cooper, Mystic Tan, Inc.
Kelly Robinson, Electrostatic Answers, LLC

Election of ESA Council Members

The ESA Bylaws provide for the election of officers every two years. Members vote for a complete slate of candidates at the annual meeting, and anyone is eligible to nominate or be part of a slate.

At this time, we have one nominated slate of candidates for this years election:

Corrected Slate of ESA Officers for 2011-2013

President

Dan Lacks, Case Western Reserve Univ.

Vice President

Shesha Jayaram, Univ. of Waterloo

Executive Council

Sheryl Barringer, Ohio State Univ.
Kelly Robinson, Electrostatic Answers, LLC
Rajeswari Sundararajan, Purdue Univ.

If anyone would like to nominate an alternate slate, please inform me well before the June conference so that we can prepare election materials for the business meeting. Absent an alternate slate, we will likely approve the current nominated slate by acclamation.

Rajeswari Sundararajan, ESA President
rsundara@purdue.edu

ESA Elections By-Laws - New Council Slates Are Sought

Based on Article 4 of the ESA Constitution, the term of the present ESA Council ends on June 30, 2008 and the new Council term of office begins on July 1, 2008. It is now time for the Secretary (address found on back page of this ESA Newsletter) to receive slates of nominees for the upcoming (7/1/1 - 6/30/13) term.

Since the Council shall be nominated as a full slate, the presenter of that slate is responsible for checking with all the members of that slate to insure each nominee is willing to serve. A slate consists of five members: the President, the Vice-President and three Council Members.

If more than one slate is presented to the Secretary, a ballot will be mailed out about April 30 (or as soon as reasonably possible) with the deadline for receipt of the ballots by the Secretary being May 31, 2011. If only one slate is presented (then as tradition has held) no ballots will be mailed, and the Membership present at the ESA Annual Meeting will be asked to vote on the slate. If no slates are presented, then, as Article 4b states, "If extraordinary circumstances prevent the election of a new Council, the existing Council shall continue in office, year by year, until an election can be held."

Electrostatics Society of America

2011 Annual meeting of the Electrostatics Society of America

June 14-16, 2011
Case Western Reserve University, Cleveland, OH, USA

The 2011 Annual Meeting will be held on the campus of Case Western Reserve University.

The meeting features 58 talks, and begins with lunch on Tuesday June 14 at noon, and ends Thursday June 16 at 4 PM.

The banquet will be held Wednesday night, June 15. The venue is the Crawford Auto Aviation Museum, which showcases antique, vintage, and classic automobiles, motorcycles, bicycles and aircraft.

Registration and housing information available at the conference website:

www.electrostatics.org/conferences.html

Conference Chairs
Daniel J. Lacks, Case Western Reserve University, daniel.lacks@case.edu
R. Mohan Sankaran, Case Western Reserve University, mohan@case.edu

Technical Program Chair
Keith Forward, MIT, kforward@mit.edu

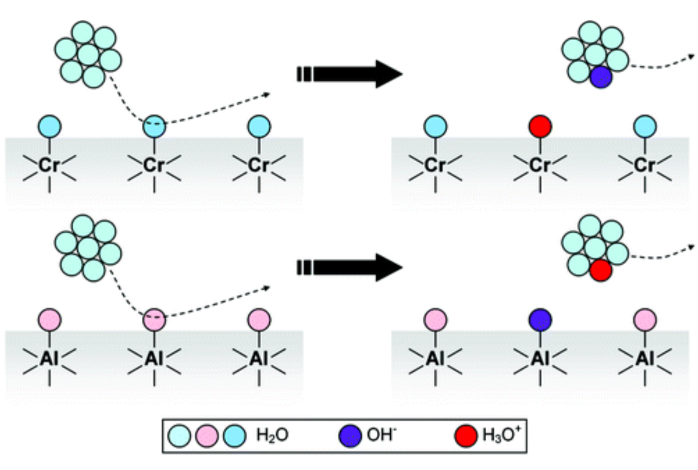
Charge Partitioning at Gas−Solid Interfaces: Humidity Causes Electricity Buildup on Metals

Telma R. D. Ducati, Lus H. Simes and Fernando Galembeck

The electrostatic behavior of dielectrics is not well understood, and this is largely due to a lack of consensus on the nature of species responsible for electrostatic charge buildup and dissipation.(1-6) Recent publications provide evidence for the participation of ions(6, 7) and electrons(8, 9) in electrostatic charging under various conditions. The effect of relative humidity (RH) on charge buildup and dissipation in dielectrics has been evidenced in recent papers from this laboratory(10-12) with an intriguing result: in many systems, charging is faster under high RH than in dry environments. This is in apparent conflict with common knowledge, according to which low humidity is conducive to the appearance of static electricity.

The effectiveness of high humidity to eliminate static charging from dielectrics is assigned in the literature to high surface conductance(13) through thick adsorbed water layers, but this widespread argument cannot explain the faster charge buildup under high humidity that has been observed in many systems studied under well-defined conditions.(10-12)

This work shows that the exposure of isolated metal samples to water vapor leads to charge buildup on the metal and presents an explanation based on water ion partitioning at the air−solid interface. The water vapor effect on metal charging was first observed in this laboratory during Faraday cup measurements to determine the charge on insulators. Charge measurements were in turn made to verify observations made in the Kelvin probe scanning microscope, showing a marked effect of RH on the ubiquitous charge distribution patterns observed on dielectrics and metals.(11)



Scheme 1. Mechanism for Charge Transfer from the Atmosphere to the Metal Surface

Charge buildup on metals under high humidity, as described in this work, is a novel example of electrostatic charging at the solid−gas interface, and it can be understood by making an analogy to the well-known behavior of solid surfaces within liquid water: they always acquire charge by some mechanism such as specific ion adsorption or ionizable group dissociation.(19) Aluminum, chromium, and SS acquire charge under high humidity and are well known for their resistance to oxidation, which is due to the coating metal oxides that protect the highly reactive metals in the bulk from the atmosphere. Water vapor adsorbs in the oxide layers, causing a number of structural changes.(20)

Al and Cr oxides are amphoteric, reacting with acids and bases. Aluminum oxides on metal contain OH and O sites with Bronsted/Lewis acid−base properties that are fairly independent of the oxidation procedure,(21) but dry aluminum oxide usually shows marked acidic character.(22) Hydroxyl groups in mixed chromium−aluminum oxides prepared by the sol−gel technique to be used as catalysts show the opposite acid−base behavior: chromium oxide sites are acidic , but aluminum oxide sites are basic.(23) This means that when the two oxides are formed together, H+ binds preferentially to Cr oxide but Al oxide rather collects hydroxyl ions from the aqueous medium. Water itself is amphoteric, acting as an acid or a base, under various conditions.

An explanation of charge buildup on metals can thus be presented as follows: adsorbed water molecules contribute OH− or H+ ions to the oxide-coated metal surface, depending on its nature and state and thus imparting excess overall charge to the isolated metal.
(excerpted from Langmuir, http://pubs.acs.org/doi/full/10.1021/la102494k)

High-speed filter uses electrified nanostructures to purify water at low cost

By dipping plain cotton cloth in a high-tech broth full of silver nanowires and carbon nanotubes, Stanford researchers have developed a new high-speed, low-cost filter that could easily be implemented to purify water in the developing world. Instead of physically trapping bacteria as most existing filters do, the new filter lets them flow on through with the water. But by the time the pathogens have passed through, they have also passed on, because the device kills them with an electrical field that runs through the highly conductive "nano-coated" cotton.

In lab tests, over 98 percent of Escherichia coli bacteria that were exposed to 20 volts of electricity in the filter for several seconds were killed. Multiple layers of fabric were used to make the filter 2.5 inches thick.

Current Events (cont'd.)

Filters that physically trap bacteria must have pore spaces small enough to keep the pathogens from slipping through, but that restricts the filters' flow rate. Since the new filter doesn't trap bacteria, it can have much larger pores, allowing water to speed through at a more rapid rate. "Our filter is about 80,000 times faster than filters that trap bacteria," Cui said. He is the senior author of a paper describing the research that will be published in an upcoming issue of Nano Letters. The larger pore spaces in Cui's filter also keep it from getting clogged, which is a problem with filters that physically pull bacteria out of the water.

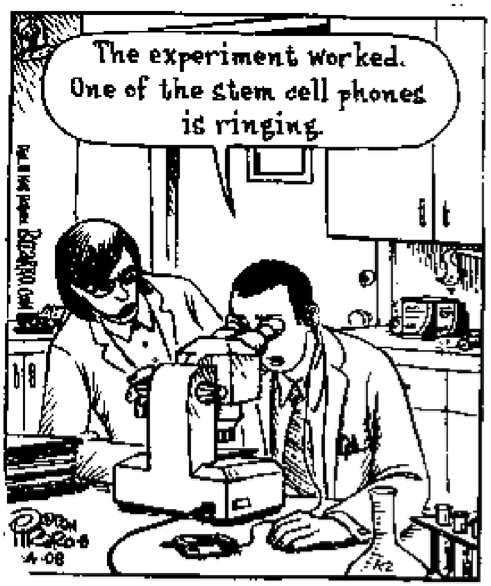
Silver has long been known to have chemical properties that kill bacteria. Cui's group knew from previous projects that carbon nanotubes were good electrical conductors, so the researchers reasoned the two materials in concert would be effective against bacteria. But the scientists also wanted to design the filters to be as inexpensive as possible. The amount of silver used for the nanowires was so small the cost was negligible, Cui said. Still, they needed a foundation material that was "cheap, widely available and chemically and mechanically robust." So they went with ordinary woven cotton fabric.

The big advantage of the nanomaterials is that their small size makes it easier for them to stick to the cotton, Cui said. Because the nanomaterials stick so well, the nanotubes create a smooth, continuous surface on the cotton fibers. The longer nanowires generally have one end attached with the nanotubes and the other end branching off, poking into the void space between cotton fibers.

The electrical current that helps do the killing is only a few milliamperes strong. In some of the lab tests of the nano-filter, the electricity needed to run current through the filter was only a fifth of what a filtration pump would have needed to filter a comparable amount of water. The pores in the nano-filter are large enough that no pumping is needed – the force of gravity is enough to send the water speeding through.

(*excerpted from http://www.rdmag.com/News/2010/08/Materials-Nanotechnology-High-speed-filter-uses-electrified-nanostructures-to-purify-water-at-low-cost/*)

Get A Charge Outta This



"Stay out of electric storms ..."

(Comics Courtesy of Glenn Schmeig)

Lines to Static Electricity

by Richard Armour (May 1956)

I touch the handle of my car
And there, old static, there you are.
You leap upon me from the handle,
As brutal as a Goth or Vandal.
My friends all smile at me and mock;
They say you're just a puny shock.

But they've not felt, as I, your voltage,
They don't appreciate your joltage.
They think it strange, no doubt, my dove,
My right hand sports a rubber glove ...
Why you're called static, I've forgot,
But when I feel you, I am not!

(Courtesy of Joe Crowley)

Electrostatics
Society of America

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ESA Information

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