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AES Newsletter

POWER UP AES MEMBERS, 2011 HAS BEGUN!

Welcome Message from the New AES President

As we start 2011, the American Electrophoresis Society is as strong as ever and growing rapidly! Research in linear and nonlinear electrophoretic applications especially in the fields of microchips and nanotechnology have exploded in the last decade. The overlap of electrokinetic tools and complex biological systems has opened up whole new analysis capabilities. What an exciting time to be an Electrophores-er!

The council has begun efforts to expand our strong programming into AES special symposia at related meetings in order to better serve our diverse membership. We hope in the next two years to reach out to: the microfluidics community via Chemical and Biological Microsystems Society (CBMS)'s annual mTAS conference (http://www.microtas2011.org), the chemical and spectroscopic community via the Federation of Applied Spectroscopy Societies (FACSS) annual conference (http://facss.org/facss/index.php) and the biological engineering community via Biomedical Engineering Society (BMES, http://www.bmes.org).

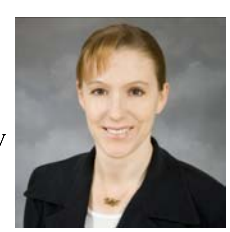
In addition, the AES council has refocused committees to a) launch a membership drive, b) begin an annual honorary award with corresponding symposia in honor of AES pillars as well as current research superstars, and c) expand our sponsorship. We are ever grateful to our loyal annual sponsors such as Bio-Rad Laboratories, CBS Scientific, Decodon, Kendrick Labs and GE Healthcare as well as new sponsors LabSmith and COMSOL. By fostering and growing strong interactions with industry, AES will facilitate electrophoresis related research and applications.

AES is also in the process of partnering with the journal *Electrophoresis* to do a special issue for our 2011 annual meeting held jointly with AIChE. We are starting a student chapter so please share this newsletter with your students and have them look us up on Facebook and LinkedIn.

As always, if there is anything the council or I can do to help facilitate your work in this "electrifying" field, please do not hesitate to contact us.

Adrienne Minerick

AES President
Associate Professor
Michigan Tech University
Chemical Engineering
minerick@mtu.edu



Inside this issue:

Many thanks to our supporters and friends for their generous contributions.

Bio-Rad Laboratories

CBS Scientific

DECODON GmbH

GE Healthcare

LabSmith

Kendrick Labs, Inc

Our traditionally strong meetings would simply not be possible without help from our supporters. Their donations are greatly appreciated.

Send news for the web page to Webmaster Adrienne Minerick
minerick@mtu.edu

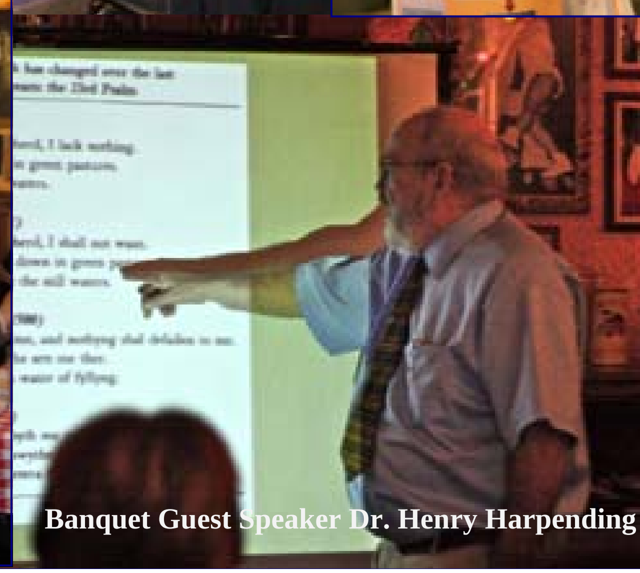
Send news for the newsletter to Editor Nancy Kendrick
nancy@kendricklabs.com

or

Assistant Editor David Garfin
degarfin@sonic.net

Contact Matt Hoelter AES Executive Director with questions about the society
matt-aes@tds.net

2010 Meeting Moments:



Banquet Guest Speaker Dr. Henry Harpending

Winners of the 2010 Poster Competition:

(*right to left*)

First Place: Ipod — **Sachidevi Puttawsamy**, **University of Missouri**, **Biological Engineering**

Second Place: ($75) — **Alice Jernigan**, **University of Arkansas**, **Chemical Engineering**

Third Place: ($25) — **Paul Jones**, **Arizona State University**, **Chemical Engineering**

Determining Dielectrophoretic Mobility in DC Insulator-based Systems *by Mark A. Hayes, Noah S. Weiss, Prasun Mahanti, and Paul Jones,* Chemistry and Biochemistry Department, Arizona State University

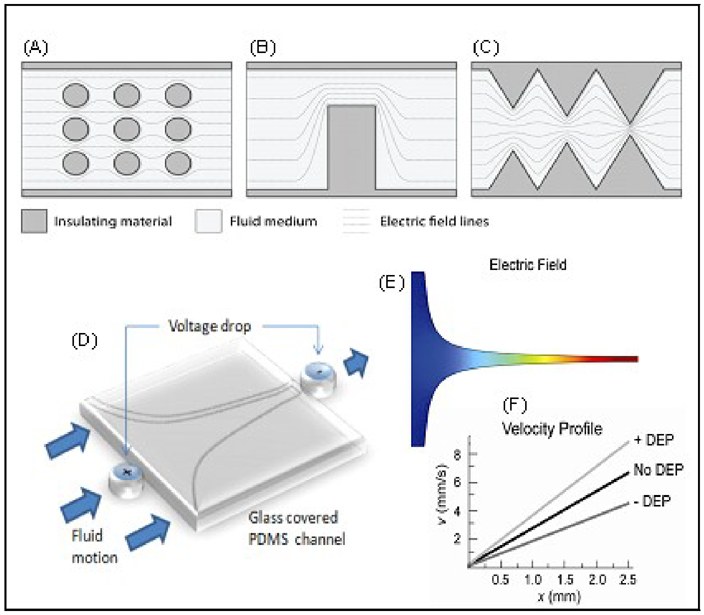
Particles are ubiquitous in our bodies and our environment. This class of materials includes cells, organelles, nanoparticles, aerosols, large proteins and DNA strands, bacteria, and viruses—among other organic and inorganic debris. As the members of AES know, dielectrophoresis (DEP), specifically insulator-based DEP (iDEP), is continuing to emerge as an important technique for manipulating these micro- to nano-scale particles. Within these important works, comparison of theoretical constructs to real-world data is only beginning. One limitation in connecting the properties of particles with dielectrophoretic (and electrokinetic) actions is a lack of valid physical descriptions based on first principles. Currently, assessments are made that ignore any subtle particle properties, or limit the discussion to polarizability and/or the Clausius-Mossoti factor. In fact, most discussions of real data rarely advance beyond an analysis of positive (towards stronger fields) versus negative (towards weaker fields) DEP.

Another approach is to define a DC-iDEP mobility according the form of electroosmotic and electrophoretic mobilities. The DEP mobility (μDEP) is defined independent of the electric field gradient and thus becomes a universal parameter. In other words this definition of DEP mobility is intrinsic to the particle and represents the relative DEP velocity per unit electric field gradient squared as shown: and, where vDEP is the DEP velocity, E is the electric field, εf is the permittivity, rp is the particle radius, Re(fcm) is the real part of the Clausius-Mossoti factor defined by the particle and medium conductivities (σ) at low frequency (f) and η is the fluid viscosity. Furthermore, an ideal method for quantifying iDEP ought to simultaneously quantify other electrokinetic effects (electroosmosis and electrophoresis).

We have initiated a strategy to quantitatively determine dielectrophoretic mobility in a converging microfluidic channel where dielectrophoretic and electrokinetic mobilities of polystyrene particles are determined simultaneously using a unique streak-based velocimetry to generate the velocity profile of particles (see figure). The electrokinetic mobilities are determined in the non-converging zone and the funnel-shaped section has a constant gradient—allowing for trivial differentiation of DC-iDEP actions. An automated algorithm detects, processes, and determines the velocities traveled by the particles at all pixels across the image sequence. Streak-based velocimetry operates by associating the length of a particle trajectory (streak) with the exposure time to estimate the velocity field.

Using 1 μm polystyrene particles the electrokinetic mobility was estimated to be 3.5×10^{-4} $cm^2/(V \cdot s)$ using the velocity data from non-converging zone and the dielectrophoretic mobility was $-2 \times 10^{-8} \pm 0.4 \times 10^{-8}$ $cm^4/(V^2 \cdot s)$ (n=3) was determined from the converging zone using the slope of the velocity profile. This result agrees with the general finding that polymeric particles exhibit negative dielectrophoresis under similar conditions. Under these particular conditions the electrokinetic velocity is about twice the magnitude of the dielectrophoretic velocity. The relative DEP velocity could be increased by increasing the applied voltage, reducing electroosmotic flow, or utilizing steeper field gradients. However, particle motion rapidly changes direction in these regimes complicating velocity associations. For optimal quantitative analysis, the DEP motion must be observable but not predominant.

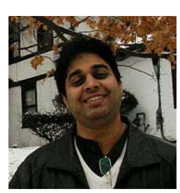
Quantitative approaches like this one enable an unprecedented evaluation of iDEP and provide a metric for standardization. Ideally, discussions will eventually evolve from subjective descriptions of particle behaviors to more objective quantitative responses.



Schematic showing A)-C) various forms of iDEP patterns, D) 3-D representation of the converging channel design, E) calculated electric field in channel, and F) velocity profiles for no, positive and negative DEP forces with the channel. Design allows for determination of particle properties for use as probes for A)-C) systems.

Dr. Mark Hayes
Arizona State University
mhayes@asu.edu

Noah Weiss
Arizona State University
ngweiss@asu.edu



Prasun Mahanti
Arizona State University
pmahanti@asu.edu

Paul Jones
Arizona State University
pjones6@asu.edu

We are pleased to announce that the 2011 AES Meeting will be held on October 16-21 at Minneapolis, MN as an AIChE Topical Conference. Mark your calendars!

The 2011 AES meeting will be held at the Minneapolis Convention Center. With nearly 480,000 square feet of trade show space, 87 column-free conference meeting rooms, a 28,000-square-foot ballroom, and an auditorium with superb production and flexible technology options, the facility can handle any event from a small meeting to a large convention. Conveniently located close to freeways and only 20 minutes from the airport on the southern edge of downtown Minneapolis, the Convention Center is easy for attendees and exhibitors to find. Plus, the convention center is connected by climate-controlled skyways to the downtown hotels, restaurants and shopping. For more information please visit www.minneapolisconventioncenter.com

#	Session Description
1	Advances In Electrokinetics and Electrophoresis - Fundamentals
2	Microfluidics: Bioanalytical Applications
3	Plenary Session of the American Electrophoresis Society
4	Microfluidics-- Detection
5	Fundamentals of Electrokinetic Flows: Novel Applications and Ionic Fluxes at Interfaces
6	Biomedical Diagnostics I
7	Nanoscale Electrokinetics
8	Electrokinetic Behavior of Microparticles and Nanoparticles: Fundamentals and Applications
9	DNA Analysis in Microfluidic and Nanofluidic Devices
10	Poster Session for the American Electrophoresis Society
11	Advances in Electrophoretic Protein Separation and Analysis
12	Electroporation and Electrophysiology
13	Award Session of the American Electrophoresis Society

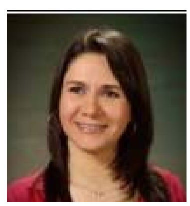
The call for papers (PTP, Proposal To Present) for the 2011 AES meeting is now open! We are excited to announce the addition of 4 new microfluidic and protein separation sessions this year! The program is sketched out in the table above. We are still looking for a few session co-chairs so please be sure to contact us if you're interested. Questions are welcome.

Please note:

The Call for Papers

- **Opens – Jan. 17, 2011**
- **Closes – May 2, 2011**

Blanca Lapizco-Encinas
CINVESTAV-Monterrey
Mexico
blapizco@cinvestav.mx
+52 81 1156-1740 x 4512



Zachary Gagnon
Johns Hopkins University
zgagnon1@jhmi.edu
410-955-4699

2011 Meeting Co-Organizers

Election Results:

Our Three New Councilors, pictured to the right, were welcomed at the 2010 board meeting in Salt Lake City.

Mark Andrew Hayes
Associate Professor
Chemistry & Biochemistry
Arizona State University
Email: mhayes@asu.edu

Christa Hestekin
Assistant Professor
Chemical Engineering
University of Arkansas
Email: chesteki@uark.edu

Alexandra Ros
Assistant Professor
Chemistry & Biochemistry
Arizona State University
Email: alexandra.ros@asu.edu