Beneath the AVS Surface

Members Source for Materials, Interfaces, and Processing News & Information

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August 2012 Issue

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Forward to a Friend

Call for AVS 40-Year Members

Over the years, AVS has recognized 40-year members of the Society at the Awards Ceremony held at the International Symposium and Exhibition. The Forty-Year Club consists of current AVS members who have been active in the Society for 40 years or more. AVS would like to continue to recognize these members; however, to ensure that we capture all members from 1972 we ask that you please notify the

Symposium Overview

AVS 59 Technical Program Now Available

Website: www2.avs.org/symposium

The AVS 59th International Symposium and Exhibition will be held October 28-November 2, 2012, at the Tampa Convention Center in Tampa, Florida. Highlights include an extensive collection of technical sessions, exhibitor technology spotlights, short courses, and a free to attend equipment exhibition.

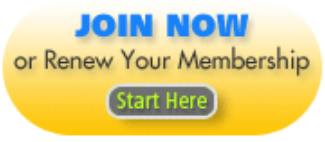
Division/Group Programs:

- Advanced Surface Engineering
- Applied Surface Science
- Biomaterial Interfaces
- Electronic Materials & Processing
- Magnetic Materials, Films & Interfaces
- Manufacturing Science & Technology
- MEMS & NEMS
- Nanometer-Scale Science & Technology
- Plasma Science & Technology
- Surface Science
- Thin Film
- Vacuum Technology

Focus Topics:

- Antinides & Rare Earths
- Biofilms & Biofouling: Marine, Medical, Energy
- Biointerphases
- Electron Transport at the Nanoscale
- Energy Frontiers
- Exhibitor Technology Spotlight
- Graphene & Related Materials
- Helium Ion Microscopy
- In Situ Microscopy & Spectroscopy
- Nanomanufacturing
- Oxide Heterostructures-Interface Form & Function

AVS office if you or someone you know is eligible for 40-year status. Please contact Angela Klink at 212-248-0200 x221 or angela@avs.org.



Upcoming Events

Prairie Chapter Symposium
September 6, 2012
Champaign, IL
Website

Rocky Mountain Chapter Symposium & Short Courses
September 18-20, 2012
Website

Minnesota Chapter Symposium & Exhibition
September 19, 2012
Website

Barrier Technologies Workshop
September 19-20, 2012
Arlington, VA
Website

Southern California Chapter Exhibit & Short Courses
October 3, 2012
Los Angeles, CA
Website

NAMBE 2012
October 14-17, 2012
Stone Mountain, CA
Website

AVS 59
Oct. 28-Nov. 2, 2012
Tampa, FL
Website

- Scanning Probe Microscopy
- Spectroscopic Ellipsometry
- Transparent Conductors & Printable Electronics
- Tribology

Tutorial:

- Nanomanufacturing: Current Status and Future Prospects

Short Courses on Vacuum and Equipment Technology:

- Analysis of Mass Spectrometer (RGA) Spectra
- Fundamentals of Vacuum Technology
- UHV Design and Practices

Short Courses on Materials and Interface Characterization:

- X-ray Photoelectron Spectroscopy (XPS or ESCA), and Auger Electron Spectroscopy (AES)
- Focused Ion Beams (FIB) and Secondary Ion Mass Spectrometry (SIMS)
- Composition Depth Profiling
- Comprehensive Course on Surface Analysis and Depth Profiling by XPS or ESCA, AES, FIB, & SIMS
- Scanning Electron Microscopy and X-ray Microanalysis
- Surface Characterization of Biomaterials

Short Courses on Materials Processing:

- Atomic Layer Deposition
- Chemical Mechanical Planarization for Microelectronics Manufacturing
- **NEW!** Industrial Ion Sources
- Photolithography Process in IC Production
- Plasma Etching and RIE: Fundamentals
- Plasma Etching and RIE: Fundamentals and Applications
- Sputter Deposition

Topical Conference on Quantitative Surface Analysis:

Website:
http://www2.avs.org/symposium/AVS59/pages/qsa.html

QSA 14, a AVS topical conference on Quantitative Surface Analysis, sponsored by the Applied Surface Science Division will precede AVS 59 on Saturday, October 28th in the Conference Center in Tampa, Florida. This small topical meeting has proven to be an energetic and thought provoking meeting allowing students and others new to quantitative surface analysis to interact in an informal way with technique experts and experienced researchers. The meeting provides practical information about the use and limitations of a variety of important methods. The program will consist of invited presentations each with an extended discussion period.

The invited program at QSA 14 will focus on best practices of XPS and TOF-SIMS analysis, quantification in SIMS, and nanoscale quantification. QSA offers an intimate environment for experts and students alike to take in and freely discuss a full day of invited content, as well as a poster session. Please take the opportunity to register for QSA 14 while registering for AVS 59 and join us for this exciting meeting.

If you are interested in presenting a poster, please submit an abstract to Lance Lohstreter, lance.b.lohstreter@medtronic.com.

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Symposium Highlights

T Cell Tete-a-Tete: Key Immune Response Players Speak Through Patterns of Proteins

68th IUVSTA Workshop
December 9-13, 2012
Hong Kong
Website

SCiMAN 7
December 10-11, 2012
San Pedro, Montes de Oca, Costa Rica
Website

PCSI-40 2013
January 20-24, 2013
Waikoloa, HI
Website

ICMCTF
April 29-May 2, 2013
San Diego, CA
Website

Event Calendar

First Announcements

Upcoming Board Meetings

2012
July 30, 2012
New York, New York

October 28, 2012
Tampa, Florida

2013
January 27, 2013
Research Triangle Park, North Carolina

April 28, 2013
San Diego, California

July 22, 2013
New York, New York

October 27, 2013
Long Beach, California

Upcoming Board Meetings

2012
October 28, 2012
Tampa, Florida

2013
January 27, 2013
Research Triangle Park, North Carolina

April 28, 2013
San Diego, California

July 22, 2013
New York, New York

Monday, October 29, 10:40 a.m.,
Room 23, Tampa Convention Center

In the body's equivalent of a radio beacon, signaling molecules carry messages to cells throughout the body. The identity of these signaling pathways is understood fairly well, but much less is understood about how cells interpret multiple signals, particularly in the case of communication between neighboring cells. These cellular tete-a-tetes are the subject of a series of recent studies by biomedical engineer Lance Kam of Columbia University in New York, N.Y., and colleagues, involving the close-range signaling processes between two immune system cells.

Kam's focus is the immune synapse, the connection between two key cellular players: T cells, which float through the body helping to identify pathogens to attack; and antigen-presenting cells (APCs), which tell the T cells which pathogens are likely threats. When this communication system works properly, the body can recognize and develop resistance to new diseases. A failure of communication between the cells, however, leads to autoimmune and neurodegenerative diseases, and can even contribute to conditions such as arthritis.

An intimate conversation between T cells and APCs takes place at the interface between the two cells. "It's not like a T cell interacting with a plastic dish, like we have in the laboratory," Kam says. The two cells bind to each other; they spread onto each other; they put new proteins into the interface between them. And these proteins at the interface, he continues, "organize into some really beautiful patterns." One arrangement is shaped like a bulls-eye, with a single protein called T Cell Receptor (TCR) surrounded by a ring of the protein ICAM-1. Another structure consists of small clusters of TCR each surrounded by its own ring of ICAM-1. In the past, researchers noted that the protein patterns at the immune synapse seemed to vary based on the signal being sent. But it was not clear whether these patterns were merely an artifact of the communication process, or whether the mechanical spacing of the proteins played a part in the conversation.

A physicist and mechanical engineer by training, Kam wanted to apply his background in microfabrication to biological questions, and he was intrigued by these patterns of proteins in the immune synapse. With much already understood about the long-range signaling pathways of the immune system, Kam felt that answering this question about the mechanical, close-range communication between cells in this immune synapse was "just really begging to be done."

In their experiments, Kam and his team designed an artificial APC and tested whether the real T cells "liked" certain configurations of proteins on its surface. Using a variety of polyacrylimide gels of varying stiffnesses, they also tested whether it made a difference to the T cells if the surface of the fake APC was rigid or soft. Previous studies had found no evidence that the rigidity of the APC could have any effect on T cells. After all, T cells circulate freely in the body and are not normally associated with the ability to generate forces. But compared to other circulating cells, T cells and APCs seemed to be a bit more touchy-feely. "They stick to each other; they kind of crawl on each other," Kam says. Perhaps, the team thought, T cells are tuned in to the rigidity of their partner cells.

Not only did the team find that the spacing of the signaling proteins mattered for the proper activation of T cells, but they found that the rigidity mattered as well. And surprisingly, this preference for rigidity was different for different species. Mouse T cells - like most cells - preferred a more rigid surface, but human T cells liked squishier partners. "This is the first time that these important receptors have been known to be sensitive to mechanical forces," Kam says.

Kam hopes that other scientists will use his team's new artificial APC platform to probe other types of cell-cell interactions beyond the immune synapse. He also hopes the work will have a direct clinical benefit for cancer immunotherapy within the next few years. This type of cancer treatment involves removing a patient's T cells, expanding their numbers, training them to recognize cancer cells, and re-injecting this fortified army into the patient. Understanding what kind of partner the T cells "like" could help to make this process, which typically relies on hard glass substrates, more effective. "We think that by learning more about the natural interface, the natural signals that activate the cells, we can get better control over the cell expansion

October 27, 2013
Long Beach, California

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- Advanced Energy Industries Inc.
- Agilent Technologies
- AJA International, Inc.
- Alicat Scientific, Inc.
- Altair Technologies, Inc.
- Asylum Research
- BellowsTech, LLC
- Bruker Nano Surfaces
- Cambridge NanoTech
- Capitol Vacuum Parts
- CeramTec North America
- Chuanbei Vacuum Technology (Beijing) Co., Ltd.
- Denton Vacuum LLC
- Duniway Stockroom Corp.
- Edwards Vacuum, Inc.
- Evans Analytical Group LLC
- FMG Enterprises, Inc.
- Gamma Vacuum
- GNB Corporation
- Helium Leak Testing, Inc.
- Hiden Analytical, Inc.
- Hine Automation
- HEUTTINGER Electronic, Inc.
- HVS Leak Detection
- Innovative Vaccum

process," Kam says, resulting in larger production of high-quality T cells that can fight cancer.

Kam and his colleagues, who include members from Columbia University, New York University (NYU) in New York, N.Y., and the University of Pennsylvania in Philadelphia, will present their results at the AVS 59th International Symposium and Exhibition.

Keeping Silver Shiny: Nanotechnology Helps Scientists and Museum Conservators Preserve Valuable Silver Artifacts

Monday, October 29, 9:00 a.m.
Room 11, Tampa Convention Center

It is tradition that whenever the U.S. House of Representatives is in session, a pedestal to the right of the Speaker's chair holds a mace, made of 13 ebony rods and topped with a silver eagle perched upon a silver globe. In October 2006, Smithsonian scientists and conservators carefully examined and conserved the mace. The silver eagle and globe, originally crafted in 1841, had acquired an aggressive purplish tarnish in the 2000s. Employees at the Smithsonian's Museum Conservation Institute spent long hours disassembling the mace, and removing and reapplying its protective coatings.

There are thousands of silver artifacts in museum collections around the world that can't receive the same time and attention as the U.S. House of Representatives' Mace. So scientists are using new technology to give conservators a helping hand. A team of researchers led by Ray Phaneuf, a professor of materials science and engineering at the University of Maryland, College Park, has partnered with The Walters Art Museum in Baltimore to investigate less labor-intensive ways to protect silver artifacts from tarnishing. The new techniques, which might keep silver surfaces shiny for longer than traditional methods, could help ensure that historically important artifacts are preserved for future generations to learn from and enjoy. The researchers will present their work at the AVS 59th International Symposium and Exhibition.

Silver tarnishes when hydrogen sulfide in the air reacts with the silver, forming an unsightly black layer of silver sulfide on the surface of the artifact. If the tarnish appears on Grandma's silver flatware set, a little polisher and some elbow grease will easily remove it. But polishing, which works by dissolving or grinding away the silver-sulfide layer, can also remove some of the underlying silver, an undesirable outcome for priceless works of art. Currently museum conservators can apply a thin layer of nitrocellulose lacquer to protect the silver. The coating is often hand-painted by a trained specialist and must be removed and reapplied an average of every thirty years. Phaneuf notes that it is difficult to apply a layer of even thickness over an entire piece, and the process of applying, removing, and reapplying the film is time-consuming.

"We did a quick back-of-the envelope calculation and found that for a big museum like the Metropolitan Museum of Art in New York, treating their entire silver collection with nitrocellulose films would likely be a never-ending task," says Phaneuf.

A quicker conservation method is to display silver pieces in an enclosed chamber with filtered air, but the chambers often leak, are expensive to install and maintain, and putting an artifact behind glass may prevent visitors from seeing the object up-close and from multiple angles.

Phaneuf and his colleagues are investigating a technique that could overcome some of the shortcomings of current preservation methods. Called atomic layer deposition (ALD), the process gives scientists atomic-level control over the thickness of a transparent oxide film that they grow on the surface of silver objects. By running a series of surface-limited chemical reactions, researchers can build the protective film one atom-thick layer at a time. The films Phaneuf and his team have tested are under 100 nanometers thick, less than 1/1000th the thickness of a human hair.

Phaneuf and his colleagues are currently experimenting by applying ALD films to highly uniform silver test wafers. The uniformity of the wafers allows the researchers to control variables, such as the composition of the silver, in order to create a model of the tarnishing kinetics as sulfur diffuses through

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MEWASA North America, Inc.

MKS Instruments, Inc.

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Plasmaterials, Inc.

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PREVAC sp. zo.o

Process Materials, Inc.

R.D. Mathis Company

RBD Instruments, Inc.

RF VII Inc.

RHK Technology Inc.

SAES Getters USA, Inc.

Scientific Instruments, Inc.

Semicore Equipment

Sequoia Brass & Copper

SPECS Surface Nano Analysis GmbH

Staib Instruments, Inc.

Sumitomo (SHI) Cryogenics of America, Inc.

Super Conductor Materials, Inc.

the ALD film.

"This is when we get to put on our physicists' hats," Phaneuf says of simplifying the test cases and building a predictive model. The test case results showed two components to the concentration profile, indicating a faster rate of sulfur diffusion through tiny pinholes in the protective oxide film. The researchers are now experimenting with multilayer films that plug these pinholes.

Before the researchers use ALD on prized museum pieces, they will need to demonstrate that the coating can be removed without damaging the artifact, and that the thin film will have a minimal effect on the aesthetic look of the silver. In terms of appearance, ALD films may have another advantage over conventional nitrocellulose lacquer, which can yellow with age. Phaneuf and his colleagues are performing tests to measure how the thickness of the ALD films affects the way silver reflects light. "Untreated silver beautifully reflects white light," Phaneuf explains. "You don't want the protective film to create interference effects that make it look blue or yellow." The expert eyes of art conservators will also help the researchers judge their success in this respect. Phaneuf says that collaborating museums may soon allow the team to test their methods on forgeries of silver artifacts, and by year's end the team should be working with genuine pieces. "There is no shortage of complex objects this method might be applied to," Phaneuf notes. "There is a lot of interest now in the conservation community in how nanotechnology and other high technologies can be used to preserve art."

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Publications News

Vacuum Technology Division Shop Note Award

The *Journal of Vacuum Science & Technology* publishes short "how to do it" articles called Shop Notes. Each year the AVS Vacuum Technology Division gives one or more awards for the best Shop Notes that appear in *JVST A* and *JVST B*.

A Shop Note should be written and illustrated so that the reader may easily follow whatever instruction or advice is being given. An abstract is not required for a Shop Note. **Click here** for instructions on submitting a Shop Note. **View Recent Winners**

Chair of the Shop Note award sub-committee is Martin Wüest. Judges are Martin Wüest (Chair), Robert Berg, Neil Peacock, Jim Fedchak and Joel Bowers.

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Membership Highlights

New AVS T-shirts: Pre-Order Now

AVS is pleased to announce the winners of the 2012 AVS Clever T-Shirt Contest. The two phrases selected for this year are:

"Great Science-No Pressure" submitted by Snjezana Balaz, The Ohio State University

Ted Pella, Inc.

Thermioinics Laboratories

Thermo Fisher Scientific

Transfer Engineering and Manufacturing, Inc.

Trillium US

U-C Components Inc.

Vacuum Engineering & Materials Co., Inc.

Vacuum Research Corp.

VAT Inc.

VG Scienta, Inc.

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"Changing the World an Atom at a Time" submitted by Shweta Bhandaru, Vanderbilt University

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