Beneath the AVS Surface: July 2011

Recently Published

**JVST A Special Issue on Atomic Layer Deposition**

This special issue is planned in collaboration with the 11th International Conference on Atomic Layer Deposition (ALD 2011) to be held at Cambridge, Massachusetts during June 26-29, 2011. The Special Issue will be dedicated to the science and technology of atomic layer controlled deposition of thin films. While a significant fraction of the articles are expected to be based on material presented at ALD 2011, research articles that are on ALD but were not presented at this conference are also welcome: the special issue will be open to all articles on the science and technology of ALD.

Papers will be reviewed using the same criteria as regular JVST articles and must meet JVST standards for both technical content and written English. To be published in JVST, the manuscript must:

1. present original findings, conclusions or analysis that have not been published previously
2. be free of errors and ambiguities,
3. support conclusions with data and analysis,
4. written clearly, and
5. have high impact in its field.

**Manuscript Deadline: August 15, 2011**

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**Symbionic Biology and the Cell Cultural Revolution**

Growing living cells on petri dishes, in test tubes and inside flasks and has been a cornerstone of biomedical research for more than a century. Cell culture, as the technique is known, is basic to everything from routine laboratory assays to advanced experiments that unravel unseen, microscopic physiology to industrial-scale processes that generate big batches of biotech drugs.

A cultural revolution of sorts
has started in recent years as laboratories across the world have been by exploring new ways to control cell growth. Where once researchers simply squirted cells into glass vessels containing nutrients, buffers, salts and chemicals, they are now starting to engineer sophisticated new ways to get cells to grow by manipulating the artificial glass environment in ways that mimic living tissue.

In the latest chapter in this revolution, which is described in the March issue of the journal *Biointerphases*, a team of scientists in Germany and Norway has developed a way to force cells to grow in predefined patterns in order to explore what are known as tunneling nanotubes -- small membrane channels around 50 to 200 nanometers wide that connect the membranes of adjoining cells.

Discovered in 2004, these tunneling nanotubes are a natural feature of cells from creatures as diverse as mice and bacteria, and they have been observed to form both in culture and in natural living tissue. Exactly what they do in the human body is not entirely clear. They may be involved in a form of intercellular communication, facilitating the exchange of material between adjacent cells -- for instance, allowing small organelles like mitochondria and electrical signals to pass between them.

They may also be involved in a wide range of diseases. For instance, in the brain they may help to spread proteins known as prions, the accumulation of which can kill neurons and cause mad cow disease or its human equivalent variant Jacob-Creutzfeld. They may also be a convenient trap door that viruses can use to jump from one cell to another and evade the immune system.

Since their discovery, the scientific community has debated their role in human health and disease, but this debate has gone largely unresolved because there was never any way to study the precise mechanisms by which these tunneling nanotubes form or function. Part of the problem is that when they form in cell culture, the process is critically dependent on the exact conditions under which those cells are grown -- how close the cells are to one another, their density, etc. But in standard cell cultures, these parameters always vary from one batch to the next.

Now Amin Rustom and colleagues at the Max-Planck Institute for Metals Research Stuttgart, the University of Heidelberg and the University of Bergen in Norway have used photolithography to etch chip-like surfaces, giving them microstructured grooved in set patterns, which force cells to grow in exactly reproducible, predefined ways.

"We provide the cells with appropriate environmental conditions and supply, and they provide us with some kind of return service," explains Rustom, who was the first to discover tunneling nanotubes several years ago.

Growing cell cultures on them allows the scientists to precisely analyze tunneling nanotube formation between cells in a detailed, statistical and...
reproducible way, allowing them to unravel interactions mediated by tunneling nanotubes that were not addressable in standard cell culture systems -- work that is now ongoing.

Rustom adds that the new cell culture system may spur the development of novel "symbionic" technologies -- combining "bionic" and "symbiosis." The technology may lead to novel applications like biochips and biosensors or functional bioimplants that have the ability to measure body functions.

"My vision for the future is a real, functional fusion of artificial/synthetic systems with living biosystems," he said.


Nothing Matters

AVS 58 Technical Program Now Available

The AVS 58th International Symposium and Exhibition being held October 30 - November 4, 2011, at the Nashville Convention Center, in Nashville, TN is rapidly approaching. Symposium and Hotel registration plus the Technical Program/Scheduler are now available.

The Symposium pre-registration deadline is October 10 and the housing deadline is October 6. The Symposium website will be updated throughout the Summer as additional information becomes available.

The AVS International Symposium and Exhibition has been developed to address cutting-edge issues associated with vacuum science and technology in both the research and manufacturing communities.

The Symposium is a week long forum for science and technology exchange featuring papers from technical divisions and technology groups, and topical conferences on emerging technologies. The equipment exhibition is one of the largest in the world and provides an excellent opportunity to view the latest products and services offered by over 200 participating companies. More than 3,000 scientists and engineers gather from around the world to attend.

AVS 2011 Major Award Winners

The AVS Awards Ceremony will be held on Wednesday, November 2, 2011, at 6:15 p.m. in Room 204-206 of the Nashville Convention Center to be followed immediately by an Awards Reception in the Grant Ballroom of the Renaissance Nashville Hotel.

Medard W. Welch Award
Dr. Wilson Ho, University of California, Irvine, "for the development and application of atomic scale inelastic electron tunneling with the scanning tunneling microscope."

Albert Nerken Award
Dr. John E. Rowe, North Carolina State University, "for his fundamental role in the development of electron energy loss spectroscopy, photoemission and synchrotron radiation techniques and their applications to surface and interface studies."
John A. Thornton Memorial Award and Lecture
Prof. Vincent M. Donnelly, University of Houston, "for innovation of surface and plasma diagnostics to evaluate the complex kinetics of plasma processing, and for the development of fundamental reaction mechanisms to explain that complexity."

Peter Mark Memorial Award
Dr. Mohan Sankaran, Case Western Reserve University, "for the development of a tandem plasma synthesis method to grow carbon nanotubes with unprecedented control over the nanotube properties and chirality."

George T. Hanyo Award
Mr. Jonathan Koch, NIST, "for the creative and technical ingenuity in vacuum sciences that has supported over 18 years of innovation at the National Institute of Standards and Technology."

AVS Fellows
AVS Fellows are members who have made outstanding contributions in areas of interest to AVS.

- André Anders, Lawrence Berkeley National Lab.
- David Cohen, Weizmann Institute of Science
- James E. Castle, University of Surrey
- Robert E. Ellefson, REVac Consulting
- Timothy A. Gessert, National Renewable Energy Lab.
- Satoshi Hamauchi, Osaka University
- Judith A. Harrison, United States Naval Academy
- Sherman L. Rutherford, Duniway Stockroom Corp.
- Stephanie Watts Butler, Texas Instruments
- Jory Yarmoff, University of California, Riverside

National Student Award Finalists
There are five (5) top-level named Graduate Student Awards and three (3) Graduate Research Awards listed below. The recipients of these awards are determined after a general competition with all the graduate research applicants and a presentation to the Awards Committee at the International Symposium. The finalists are:

- Justice Alaboson, Northwestern University
- Joseph E. Baio, Univ. of Washington, Seattle
- John G. Gibbs, University of Georgia
- Sondra Hellstrom, Stanford University
- Andrew J. Lohn, Univ. of California, Santa Cruz
- David A. Siegel, Univ. of California, Berkeley
- Kangkang Wang, Ohio University
- Bingjun Xu, Harvard University

Dorothy M. and Earl S. Hoffman Award
Nellie Yeoh Whetten Award
Dorothy M. and Earl S. Hoffman Scholarships
Graduate Research Awards

Nominations for the 2012 awards are currently being solicited. For more information, please contact Angela Klink, AVS, 212-248-0200 X 221, fax 212-248-0245, angela@avs.org.

AVS Store--Video Courses on Sale
Announcing a new low price for the AVS video courses. Each course is now presented in video DVD format for $75.00. The price includes one course book. The video courses available include:

- Properties of Vacuum System Materials now available on two DVD's. This six hour, eight lesson course covers materials used for vacuum system construction as well as materials used in vacuum applications.
**Sputter Deposition** is available on three DVD's. This six hour, 20 minute course on the aspects of sputter deposition is presented in eight 8 lessons. The course provides the student with a solid understanding of the different sputtering methods and their applications. The fabrication of thin films and device structures is examined with emphasis placed on material transport, film growth, alloy and compound deposition, and reactive processes. Thin film technologies presented include ion beam, glow discharge, and magnetron sputtering.

**Fundamentals of Capture Pumping** is now on three DVD's is a nine hour course covering the class of vacuum pumps known as capture pumps. The course is divided into seven sections. It includes a brief introduction to vacuum technology and a section on vacuum pumps in general before going in-depth into the characteristics and operation of vacuum capture pumps.

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**In Memory of R. Norman Peacock**  
*By Neil Peacock with assistance from Jack Singleton*

R. Norman (Norm) Peacock died on May 18, 2011, after a 22 year battle with Parkinson disease. Norm was a long-time Member of AVS, becoming a 40-year Member in 2007. He recollected that between 1962 and 1998, when he attended his last AVS International Symposium and Exhibition, he had missed only one of the Symposia, and that was due to a conflict of meetings!

Early in life he developed an avid interest in electronics, photography, and all things mechanical, especially in how they worked. In 1948, he was the Oregon winner of the Westinghouse National Science Talent Search. His project included making his own Sprengel high vacuum pump, an outgrowth of his desire to learn more about vacuum tubes. He received his B.S. in Physics in 1952, and a M.S. one year later, both from the University of Oregon.

Part of 1954 was spent in the Vacuum Laboratory at the Westinghouse Research Laboratories at a time of extraordinary development in technology. The Bayard Alpert ionization gauge had just been invented and simple procedures for the attainment of UHV were being developed. There were literally dozens of small vacuum systems in operation, exploring all aspects of technique and equipment development. When Norm described this period, many years later, he was still reveling in that time!

In 1958, he earned his Ph.D. from the University of Illinois, using UHV techniques for surface physics research. He did all the glassblowing to make his UHV vacuum system, as well as designing and building all the associated electronics necessary for his PhD thesis project. After post doc work in Europe, he became Associate Professor of Physics at the University of Illinois from 1962 to 1971, and was a member of the Coordinated Science Lab, directed by Dan Alpert for part of the time. In the early 1960s, this lab was responsible for UHV developments such as the Schuemann gauge. Dan Alpert was the editor of a new journal, called the Journal of Vacuum Science and Technology (JVST) and Norm recollected a meeting in Dan's office with Frank Propst, JVST associate editor, to discuss whether surface science papers should be published in JVST.

In 1971, Norm switched from academia to the commercial aspects of vacuum technology, spending five years as Vice-President of R & D at the Granville-Phillips Company before co-founding HPS Corporation. One of his achievements was "Americanizing" the KF (KleinFlansch) system from Europe by redesigning them to have stub dimensions that easily interfaced to US vacuum tubing sizes.

During his long membership in AVS, he served as the Chair of the Vacuum Technology Division in 1988 and taught short courses in "Total Pressure..."
Gauging" and "Vacuum Sealing and Joining Techniques" for many years. He also served as the AVS representative to the IUVSTA for Vacuum Science 1989-1995, serving as the IUVSTA Vacuum Science Division Chair for 1992-1995. He was co-editor of the Proceedings of the 1995 IUVSTA Congress, published in the journal "Vacuum." He was a member of the AVS History Committee when it was re-established in 1991 and was a supporter of efforts to record the history of vacuum components, an interest being carried on by his son, Neil. He was always generous in any discussion of vacuum technology, with special joy when it centered on the UHV. His achievements were recognized when he became an AVS Fellow in 1995 "For contributions to vacuum technology in the areas of sealing and joining technologies and pressure measurements."

Norman Peacock was unable to contribute to the AVS in person for all too many years, but continued to contribute by writing chapters for recent books on vacuum technology. Vacuum was just one of the many areas in which he loved to teach and instruct. He was a voracious book reader, and loved learning new skills. He will always be remembered with great affection by those of us lucky enough to have spent time with him.