

# Beneath the AVS Surface

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



January 2014

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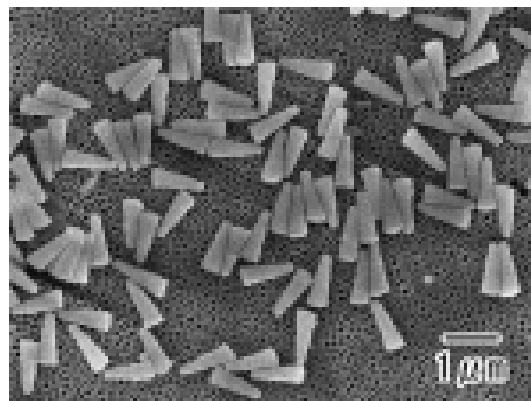


## Publications Highlights

Out of One, Many: New Method Creates Plethora of Nanometer-sized Particles from a Thin Film of Material

Article: ["Fabrication of monodisperse particles by nanoimprinting using anodic porous alumina molds," JVST B 32\(1\), Jan/Feb 2014](#)

Tiny, shape-controlled particles are grist for the nanotechnology mill. The nano-sized materials find uses as catalysts, biomarkers, and platforms for chemical sensors. Now researchers from Japan's Tokyo Metropolitan University have developed a faster way to make large quantities of the practical particles. They report the new method in a paper in the *Journal of Vacuum Science and Technology B*.



Scientists had previously experimented with a large number of different ways to manufacture small particles, but most of the methods remain limited by slow speeds or the low quantity of particles they are able to produce. For example, in the template process small particles are formed in the pores of a starting material, but the template material must be dissolved in order to free the particles, simultaneously dissolving any chance of using the template more than once.

To see if they could churn out greater quantities of small particles more quickly, Hideki Masuda, a chemist at the Tokyo Metropolitan University, and his colleagues decided to experiment with a reusable mold.

The researchers created the mold out of aluminum, first forming an ordered array of small indentations in the metal, and then hollowing out cylindrical holes around each indentation site through the process of anodization. Once the mold was complete, they pressed it into a thin film of photocurable monomer to create a forest of tiny cylindrical polymer projections.

This general stamping process, called nanoimprinting, had been used before by other researchers to prepare tiny, finely detailed structures. What is unique about Masuda and his colleagues' approach is the novel way the researchers found to "chop" their forest of cylindrical projections into individual logs.

## Upcoming Events

Florida Chapter

March 3-4, 2014  
Orlando, Florida  
[Website](#)

ICMCTF 2014  
April 28-May 2, 2014  
San Diego, CA  
[Website](#)

5th International  
Conference on Plasma  
Medicine  
May 18-23, 2014  
Nara, Japan

Functional Coatings  
and Surface  
Engineering (FCSE-  
2014)  
June 15 to 18, 2014  
Quebec, Canada  
[Website](#)

PEC 2014  
June 25-27, 2014  
La Crosse, WI  
[Website](#)

ALD 2014  
June 15-18, 2014  
Kyoto, Japan  
[Website](#)

IIT 2014  
June 27-July 4, 2014  
Portland, OR  
[Website](#)

IVNC 2014  
July 7-10, 2014  
Engelberg,  
Switzerland  
[Website](#)

ICN+T 2014  
July 20-25, 2014  
Vail, CO  
[Website](#)

Eighteenth  
International  
Conference on  
Molecular Beam  
Epitaxy  
Sept. 7-12, 2014  
Flagstaff, AZ  
[Website](#)

2014 PNWAVS  
Symposium with  
PREMIER  
Sept. 16-19, 2014  
Richland, Washington  
[Website](#)

PacSurf 2014  
Dec. 7-11, 2014  
Kohala Coast, HI  
[Website](#)

[Event Calendar  
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To separate the individual cylinders the researchers coated the forest with a sacrificial layer of a masking agent containing butadiene rubber, and then mechanically peeled the layer off the underlying substrate. The team then dissolved the sacrificial layer and the individual polymer particles floated free.

Masuda says he was surprised by how easily the projections could be detached. He predicts that the uniformly sized and shaped particles could be used most immediately as biomarkers or biocarriers.

The team also experimented with creating nano-sized cylinders of different aspect ratios, from short and squat to long and slim, and with creating tapered nanoparticles from silicon dioxide ( $\text{SiO}_2$ ).

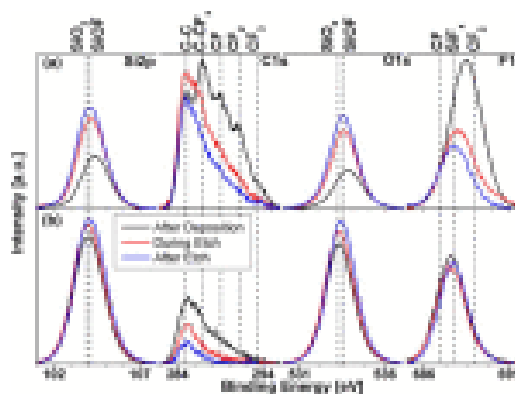
Masuda notes that altering the geometrical structure of the mold gives scientists precise control over the size and shape of the particles. Going forward, his team plans to prepare aluminum molds with square and triangular holes.

To make their nanoimprinting method even more efficient, Masuda says the team may also investigate how to adapt it for high throughput roll-to-roll manufacturing.

## Close Shave: A Milestone for Atomic Layer Etching (ALE)

Article: ["Fluorocarbon assisted atomic layer etching of  \$\text{SiO}\_2\$  using cyclic Ar/ \$\text{C}\_4\text{F}\_8\$  plasma," JVST A 32\(2\), Mar/Apr 2014](#)

Just like excess pounds after the holidays, it seems that when it comes to manipulating an atom-thin layer of material, it's easier to put it on than take it off. Researchers have experimented successfully with atomic layer deposition (ALD), adding atom-thin layers of material to a surface, for years. But the flip side of that process - atomic layer etching (ALE), in which a similarly skinny layer of material is removed - has lagged behind.



Now researchers from the University of Maryland have demonstrated a way to trim an atom-thin layer off of a film of silicon dioxide ( $\text{SiO}_2$ ) using a self-limiting procedure, by treating it with a carefully controlled layer of fluorocarbons and then bombarding it with argon ions.

"[Self-limiting ALE] is an area which many people have thought about for a long time," said lead investigator Gottlieb Oehrlein of the University of Maryland at College Park.

Though researchers have chipped away at atomic layer etching since the 1990s, it has remained elusive. Generally speaking, ALE is a two-part process: first a reactant is applied to a film's surface, then energy is used to knock the affected particles off the surface. In the past, researchers would typically apply excessive amounts of reactant and use specific reactant-film combinations to stop the reaction after one atomic layer. In practice, Oehrlein said, this has been difficult to achieve, leading to a lack of atomic-level precision. Additionally, in prior work the amount of material coming off was not monitored in real time.

With their new method - described in a recent issue of the AVS' *Journal of Vacuum Science and Technology A* - the researchers have both more

## Upcoming Board Meetings

**April 27, 2014**

San Diego, California

**August 4, 2014**

New York, NY

**November 9, 2014**

Baltimore, Maryland

## Corporate Members

Advanced Energy Industries Inc.

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control over the process and the ability to monitor what is happening at the surface. In their experiment, the reactant is a precisely applied layer of fluorocarbon (FC) and the film to be etched is SiO<sub>2</sub>. The silicon reacts with the fluorine in the FC to form volatile products, which can escape from the surface. Bombarding the film with bursts of argon ions knocks these volatile products off. Unlike previous method, this process is highly controlled and self-limiting: once the fluorine supply exhausts itself, the etching reaction stops.

"By controlling the amount of chemical reactant on the surface precisely, we can control the amount of SiO<sub>2</sub> removed," Oehrlein said. The new etching method, he continued, is "very sensitive," and allowed the team to achieve sensitivity down to one angstrom.

This work is the first to experimentally examine a self-limiting ALE process for SiO<sub>2</sub>. Two computer modeling studies from the late 2000s predicted that this technique would be possible with SiO<sub>2</sub>, and Oehrlein said the modeling results are "very consistent with what we find in our work."

Moving forward, the team will look at other materials beyond SiO<sub>2</sub> and will try to apply this technique beyond flat surfaces and onto patterned surfaces with 3-D structures. Oehrlein reports that the new method could give a boost to all nanofabrication technologies, such as those used to make smartphones and computers.

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## AVS 61 Updates



### AVS 61 Topics

The AVS 61st International Symposium and Exhibition will take place November 9-14, 2014, in Baltimore, Maryland. The Call for Abstracts will be launching in February. In the meantime, here is the list of topics for 2014. AVS members, please remember to login to MyAVS to review [Presentations on Demand](#) from AVS 60, AVS 59, and ALD 2013.

#### Division/Group Programs:

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

#### Focus Topics & Other Sessions:

- 2D Materials
- Accelerating Materials Discovery for Global Competitiveness
- Actinides & Rare Earths
- Atom Probe Tomography
- Conservation Studies of Heritage Materials

Omicron Nanotechnology  
USA, LLC

Oxford Instruments -  
Austin Scientific

Pfeiffer Vacuum  
Technology

Physical Electronics

Plasmaterials, Inc.

Plasma-Therm

Precision Plus Vacuum  
Parts

Process Materials, Inc.

R.D. Mathis Company

RBD Instruments, Inc.

RF VII, Inc.

RHK Technology Inc.

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Sequoia Brass and  
Copper

SPECS Surface Nano  
Analysis GmbH

Staib Instruments, Inc.

Sumitomo (SHI)  
Cryogenics of America,  
Inc.

Super Conductor  
Materials, Inc.

Ted Pella, Inc.

Thermo Fisher Scientific

Transfer Engineering and  
Manufacturing, Inc.

U-C Components Inc.

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Fundamentals & Biological, Energy & Environmental Applications of  
Quartz Crystal Microbalance  
Helium Ion Microscopy  
In Situ Spectroscopy & Microscopy  
Materials Characterization in the Semiconductor Industry  
Novel Trends in Synchrotron & FEL-Based Analysis  
Scanning Probe Microscopy  
Selective Deposition as an Enabler of Self-Alignment  
Spectroscopic Ellipsometry  
Surface Modification of Materials by Plasmas for Medical Purposes  
Tribology

## AVS 61 Ambassador Program

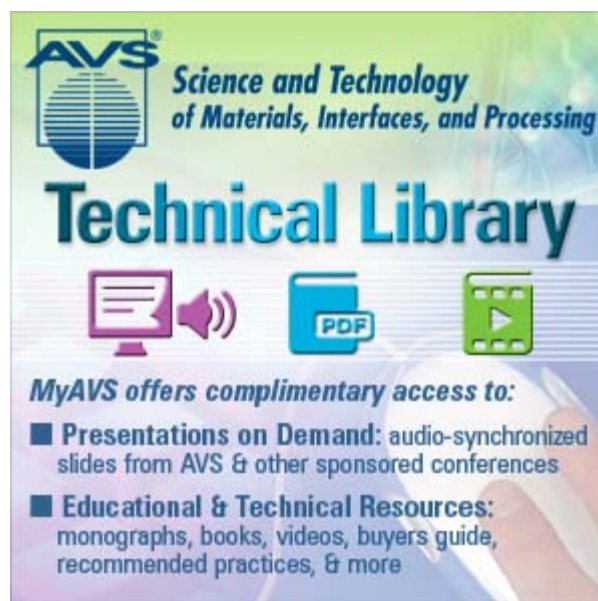
At the AVS 61st International Symposium and Exhibition which will take place November 9-14, 2014, in Baltimore, Maryland we will be offering an AVS Ambassador program (referred to as Buddy program at AVS 60) where first time Symposium attendees are paired with researchers that have attended the Symposium in the past and have similar research interests. The AVS Ambassador will be certain the colleague is aware of special events, including the business meetings of the divisions and groups, the welcome mixer, awards ceremony, etc.; introduce the colleague to leading researchers in their field of study; and stress AVS membership benefits.

All AVS members can serve as an AVS Ambassador. If you are interested in being an AVS Ambassador, please contact the Chair of the AVS division/group(s) you would like to help. Please visit the [Chapters, Divisions, and Groups](#) webpages to obtain contact information or e-mail either [Vin Smentkowski](#) or [Dave Surman](#).

Serving as an AVS Ambassador is a great way to become involved in and help your division/group!

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## Membership Highlights



The advertisement features the AVS logo at the top left, with the text "Science and Technology of Materials, Interfaces, and Processing" to its right. Below this, the words "Technical Library" are written in a large, bold, blue font. Underneath, there are three icons: a purple monitor with a speech bubble, a blue book with "PDF" written on it, and a green play button. At the bottom, there is a list of benefits under the heading "MyAVS offers complimentary access to:".

**MyAVS offers complimentary access to:**

- **Presentations on Demand:** audio-synchronized slides from AVS & other sponsored conferences
- **Educational & Technical Resources:** monographs, books, videos, buyers guide, recommended practices, & more

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## AVS 2014 Call for Award Nominations

Do you know people in areas of interest to the AVS, should be recognized?

### Professional Awards Nominations Deadline: March 31, 2014

- Outstanding research: Medard W. Welch Award
- Outstanding discoveries and inventions: Gaede-Langmuir Award (this award will be given biennially in even-numbered years)
- Outstanding contributions to the solution of technological problems: Albert Nerken Award
- Outstanding research or technological innovation with emphasis on the fields of thin films, plasma processing, and related topics: John A. Thornton Memorial Award (this award will be given biennially in odd-numbered years)
- Outstanding theoretical or experimental work by a young scientist or engineer: Peter Mark Memorial Award
- Outstanding performance in technical support of research and development: George T. Hanyo Award
- Outstanding theoretical and/or experimental research of interest with special emphasis on surface processes at a fundamental atomic and molecular level, as well as outstanding leadership at the international level: Theodore E. Madey Award for Surface Science and Scientific Exchange Deadline May 2, 2015
- Sustained and outstanding technical contributions: Fellow of the Society
- Eminent service to AVS: Honorary Membership

### National Graduate Student & Divisional Award Nominations: Deadline: May 5, 2014

#### Outstanding research by a graduate student:

The AVS National Student Awards include five (5) top-level awards and three (3) Graduate Research Awards (GRAs). The top-level AVS Graduate Student Awards include: Russell and Sigurd Varian Award, Nellie Yeoh Whetten Award, Dorothy M. and Earl S. Hoffman Award and Dorothy M. and Earl S. Hoffman Scholarships.

In addition, numerous Divisional Awards in technical areas of interest to AVS are available. Students may apply for a National Student Awards (Graduate Research Award/Top Level Award) and one Division Group Award in a given year. There will be one application form and package. [Click here for details and application forms.](#)

**AVS Membership Renewal Season** AVS membership renewal season officially started on November 15, 2013. If you attended the AVS 60th International Symposium and Exhibition your membership was automatically renewed. If you did not attend please use our [online renewal form](#) to save yourself some time!

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Conference Highlights

# Presentations on Demand

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## Ohio Chapter Meeting Summary

On Tuesday, October 8, 2013, the AVS Ohio Chapter hosted a meeting open to all those in the within the Chapter boundaries interested in attending. Forty-five participants enjoyed a series of five invited talks with speakers from around the state, including the nearby Air Force Research Laboratory, Case Western Reserve University, and Ohio State University. The meeting also featured an equipment exhibition, and a student poster competition.

Special congratulations to poster competition winners Souvik Ghosh (1st Place) and Jonathan Cole (2nd Place). Both students are advised by Mohan Sankaran in the Chemical Engineering Department at Case Western Reserve University. The meeting was hosted at the University of Dayton, institution of 2013 AVS Ohio Chapter Chair, Christopher Muratore. Special thanks to meeting sponsors, Leybold and Eerie Tech Group for sponsoring the meeting. The Chapter looks forward to future events, with next year's chapter meeting to be held near Cleveland in Fall 2014 with details forthcoming.





Souvik Ghosh (CWRU)  
1st Place



Jonathan Cole (CWRU)  
2nd Place

### ICMCTF Recent Discoveries Abstracts



After the close of the ICMCTF abstract submission site, we have received a number of enquiries from colleagues about submitting abstracts on recent discoveries and wishing to present these exciting results at the: 41<sup>st</sup> ICMCTF (April 28 - May 2, 2014, Town and Country Hotel, San Diego).

In response, we will consider abstracts of this nature through March 3rd, 5 p.m. (USA, CST). Please send the abstract directly to the program chair of ICMCTF 2014, at: [claus@ucy.ac.cy](mailto:claus@ucy.ac.cy).

The abstract should include title, list of authors, work and country affiliations, and should not exceed 300 words. Please indicate the corresponding and presenting author(s) with complete contact information.

For more ICMCTF information such as preliminary program, short courses, hotel accommodation, Conference Proceedings manuscript submission, etc., please visit the conference website: <http://www2.avs.org/conferences/icmctf>

Conference Pre-Registration is now open.

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## Nothing Matters

### AVS Online Jobsite Offers Internship Postings

AVS has an online jobsite that offers free 60-day internship job postings. To post internships online at AVS, visit the [AVS Online Career Center](#). Locate the best fit for your organization by reaching the future of the science community - AVS members. Free internship postings are valid on 60-day online-postings; valid intern-level opportunities are defined as limited-term (up to 12 weeks) employment

for current undergraduates or recent bachelor degree recipients with financial compensation (if any) in the form of a modest salary or stipend. "Internship" Job Level must be selected when posting to access this offer.

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## NAE 50th Anniversary Video Contest

The NAE is turning fifty this year! To celebrate its 50th Anniversary, the NAE is hosting a video contest. This contest is envisioned as an opportunity to start a public discussion about the importance of engineering and is open to everyone. The goal is to highlight the nexus between engineering and the welfare of humanity and the needs of society.

Do you have an engineering story that you would like to share? Isn't there an engineering tale that you've always wanted to tell the world about? It can be one of your past achievements or that of a colleague's, or perhaps simply an engineering feat you foresee.

Produce a short 1- or 2-minute video showcasing how engineering connects to the quality of life, the nation or the world. You can use a camera, a tablet or a phone to make your video - it doesn't need to be professionally done. You can partner with a colleague, work with one of your students or your children/grandchildren to tell your story. Just be sure to tell it!

The Grand Prize is \$25,000 and there are other cash prizes. All the details can be found at [Engineering for You \(E4U\) Video Contest](#).

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