Welcome to the first issue of Beneath the AVS Surface. In addition to Society news this newsletter will cover recent scientific and technical highlights relevant to AVS members.

The newsletter will be a work in progress and we hope to expand technical coverage with each issue. Please note that both Society news and technical contributions may be sent to Della Miller, della@avs.org at the first of each month for the following months issue.

Recently Published

When it Comes to Integrated Circuits, Is Less Always Moore?

Optical lithography, long the favored approach to patterning integrated circuits, may be nearing the limits of its fiscal feasibility. After 50+ years of Moore's law--that the number of transistors on integrated circuits would double every two years--what will it take to keep the doubling going?

Such is the question posed in the article, "To charge or not to charge: 50 years of lithographic choices" by R. Fabian Pease, Stanford University, that appears in the JVST B (28 (6), Nov/Dec 2010).

Although competing technologies debuted in the early 1960s, optical patterning outpaced its competitors in improvements. By the 1990s, it had taken integrated circuit manufacturing from 25-micron features to densely packed features less than 10 nanometers wide, while greatly improving the speed of production. Unfortunately, costs kept pace.

"We now have a well-established optical lithography technology that finally is becoming so complicated, expensive and restrictive in the patterns that can be printed that industry leaders are now seriously considering alternatives," says Pease in his paper.

According to Pease, the time might finally have arrived to consider other solutions, including charged-particle lithography, uncharged-particle lithography, or simple localized mechanical contact (aka nano-imprinting). He evaluates these solutions according to the number of minimum features per second per dollar that are manufacturable at an acceptable defect rate.

In the end and barring a crisis, Pease predicts, the unknown risks of abandoning optical techniques will motivate manufacturers to continue using them. For now, gradually introducing other approaches as supplements to optical technologies appears a more likely next step.

Pease also questions the value of going ever smaller as transistors grow leakier and as interconnections suffer from increasing resistance per unit length while inductance and capacitance remain unchanged. He suggests that a combination of techniques, or possibly three-dimensional integration, could allow industry to continue matching the pace of Moore's law without resorting to Lilliputian solutions. Read More
In the last few years, Singapore's focus on education and R&D--especially in the biomedical sciences--has attracted international attention. The *Biointerphases* 5 (3) September, 2010 issue explores the growth of this nation's research programs, with a focus on biointerphase science.

Fifteen papers highlight research projects underway in Singapore. Studies of how red blood cells bind to endothelial cells and how to prepare biofilms are included, as well as high-throughput microarray approaches for analyzing enzymes and techniques for creating artificial livers.

Some highlights include:

- Lim Chaun Poh, Chairman of Singapore's Agency of Science, Research and Technology (A*STAR) presents an overview of efforts to advance R&D in the nation of 4.5 million people--from the biomedical hub Biopolis (celebrated by Lord Martin Rees, the President of the Royal Society in the U.K.) to the opening of Fusionopolis in 2007, a facility that promotes interdisciplinary research. - Bertil Andersson, Provost of the Nanyang Technology University, explain the goals and history of this university, which collaborated with universities across the world to create the Center for Biomimetic Sensor Science. Established in 1955, NTU is the youngest of the world's top 100 and maintains a heavy focus on engineering. "It is probably the world's largest engineering-based institution on a single campus," Andersson writes. Its core areas of research, which have attracted top talent from around the world and young investigators through the National Foundation Research Fellowships, include sustainability research, medicine and health, new media, China and Asian studies and the application of new technologies. Read More

- Barry Halliwell, Deputy President of Research and Technology at the National University of Singapore, describes his institution's recruitment efforts, the broad range of topics studied at this university and its mission to "transform the way people think and do things through education, research and service." Read More

To read an introduction to the special section, see the article, "In Focus: Biointerphase Science in Singapore" by Bo Liedberg and Wolfgang Knoll. Click Here

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**Surface Science Spectra Highlights**

**By James Castle, SSS Editor**

In the late 1950's, as part of my Ph.D. studies I had a need to remove ppm traces of hydrocarbons from otherwise pure oxygen (I had discovered that they influenced the oxidation of magnesium). As a result I came to appreciate the efficacy of the Arneil catalyst (copper oxide on Kieselguhr) for this purpose. Now, in the volume of *SSS* that is just going to print we have a fine set of spectra from a modern version of this class of catalysts in which CuO and other oxides are distributed within a perovskite structure. The following are three articles found in volume 15 from the group at the Università di Padova, Italy, which deal with the distribution of metals oxides on porous supports to yield enhanced catalytic activity.

**CuO/La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-d} Powder by XPS**

Marta Maria Natile, Alessandro Galenda, Fabio Poletto, and Antonella Glisenti Università di Padova, Dipartimento di Scienze Chimiche, via F. Marzolo, 1, Padova, 35131, Italy

**Abstract:** A CuO/La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-d} supported system was obtained by depositing, by wet impregnation, 10 wt% CuO loading on the La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-d} surface. The surface properties are investigated by means of XPS. Besides the wide scan spectrum, detailed spectra for the La 3d, Sr 3d, Co 2p, Fe 2p, Cu 2p, O 1s, and C 1s regions, and related data, are presented and discussed. Read More

**From La_{2}O_{3} To LaCoO_{3}: XPS Analysis**

Marta Maria Natile, Alessandro
**Abstract:** Nanostructured LaCoO₃ powder was prepared by a new approach: cobalt oxide nanoparticles were deposited, by wet impregnation, on the La₂O₃ surface. The La₂O₃ support was prepared by precipitation from a basic solution of La(NO₃)₃·6H₂O. The precipitate was dried at 353 K for 2 h and calcined at 923 K for 6 h in air. Nanostructured LaCoO₃ was obtained by wet impregnation of La₂O₃ with aqueous solutions of Co(NO₃)₂·6H₂O: [Co/La]nominal = 1.0 (nominal atomic ratio is obtained from the precursors weighed quantities). The obtained suspension was maintained under stirring for two days and then kept in rest for one day. Water was evaporated in air and the obtained solid was dried at 353 K for 2 h and at 923 K for 6 h in air. The thermal treatment in air promotes a solid state reaction between La-O and Co-O and then the formation of LaCoO₃.

**La₀.₆Sr₀.₄Co₁₋₀₉Fe₀₂₋₀₉O₃₋₀₉ Powders Studied by X-ray Photoelectron Spectroscopy**

Fabio Poletto, Marta Maria Natile, Alessandro Galenda, and Antonella Glisenti
Università di Padova, Dipartimento di Scienze Chimiche, via F. Marzolo, 1, Padova, 35131, Italy

**Abstract:** Perovskite-type oxides, ABO₃, are known to be very good oxidation catalysts. The redox properties of the B cation, the availability of weakly bonded oxygen at the surface and the presence of lattice defects have been often claimed as responsible for their catalytic activity. Moreover, their performances can be improved if they are nanodimensioned. The present study focuses on the development of new LaCoO₃-based catalysts for alcohol (such as methanol, ethanol) steam reforming. Several La₀.₆Sr₀.₄Co₁₋₀ₓFeₓO₃₋₀ₓ (x=0.2, 0.5, 0.8) were prepared by the citrate gel method and calcined at 1073 K for 5 h in air. Herein, the influence of the cobalt/iron ratio on the surface properties was investigated.

**Nothing Matters**

**Iridescent Glass Puts a New Twist on Nanotech**

Last year, researchers in Canada created a nanoscale glass film that could someday decorate devices, lower energy bills and improve pharmaceuticals.

The self-sustaining silica possesses a valuable property: chiral nematic organization-twisting, threadlike spaces running throughout the material, imbuing it with the iridescence of tropical beetles. It is not merely beautiful; the helical pores also endow the glass with properties useful in surface coatings, optical polarization and chemical sorting.

"People around the world have been trying to make these types of materials, but have found that their glass lacked chiral nematic organization," says Mark MacLachlan of the University of British Columbia chemistry department. The research was published in the Nov. 18 issue of Nature.

Researchers used nanocrystalline cellulose (NCC), a natural carbohydrate with a helical structure, as a template for their glass. They then burned away the NCC, leaving behind a silica film akin to a plaster cast of the NCC’s spiral threads.

The structure of nanomaterials determines their properties and applications. The helical pores of these silica films reflect different wavelengths of light selectively, making them good filters. Windows, cars or buildings coated with silica film "tuned" to exclude undesirable wavelengths, such as UV or infrared light, could keep heat out or in, making them cheaper to heat or cool. Because the films' structures selectively reflect circularly polarized light, they might also prove useful in optical devices.

A nanostructure's value also derives from its ability to interface with other structures, including molecules. Here, too, the silica film shines. Some molecules (called enantiomers) share a molecular formula and constitution...
in common, but differ in their atomic orientation. It is as if they were right- and left-handed versions of the same molecule. The silica film's chirality, or "handedness," allows it to "shake hands" with molecules of the same chirality—a useful quality in chemical sorting.

The article, "Free-standing mesoporous silica films with tunable chiral nematic structures" by Kevin E. Shopsowitz, Hao Qi, Wadood Y. Hamad & Mark J. MacLachlan appears in the November 17, 2010 issue of the journal Nature (468, 422-25).

Membership Highlights

AVS Membership Now Includes a Yearly Online Subscription to Surface Science Spectra

Surface Science Spectra (SSS) is an international journal and database devoted to archiving spectra from surfaces and interfaces, SSS offers convenient and easy access to peer-reviewed spectral data from on-going international industrial and academic research. Surface Science Spectra publishes reference, comparison, and technical spectra representing a range of spectra including XPS, AES and SIMS. SSS features:

- Over 780 different materials including more than 4,330 published spectra
- Downloadable data you can compare digitally to your own results
- Assists with quantitative analysis of your data
- Truly usable reference spectra
- Each spectrum in its unsmoothed and un-manipulated form so that you know you're looking at original data, not someone else's interpretation.
- Focused-topic submissions which contribute to the completeness of the archival database
- Collections of spectra on materials of particular interest to the community.

SSS archives, in a systematic and uniform format, surface data from a wide range of fields—giving you and the latest findings from new research and materials important to your work.

Please consider submitting your own data to SSS, the only peer-reviewed and archival resource for reference data on surface analysis. Submission Information

If you are an AVS member you can access this journal with the SAME username and password that you currently use to access other Scitation services. Login Here. If you experience technical difficulties when accessing the journal, please contact help@scitation.org. For general questions about your subscription(s) contact angela@avs.org.

AVS Prairie Chapter Award for Outstanding Research

The purpose of this award is to encourage and reward outstanding research in materials, interfaces, or processing. The award consists of $1,000, a certificate setting forth the reasons for the award, and an honorary lectureship at the annual Prairie Chapter meeting. Up to $500 for travel expenses to the meeting at which the award is presented will be reimbursed. A nominee must have accomplished outstanding research of a theoretical or experimental nature in a field related to materials, interfaces, or processing. The nominee must have been a member of the AVS for a minimum of five continuous years at the time of nomination and must be a current member of the Prairie Chapter. Special consideration will be given to nominees who have demonstrated a commitment to the AVS through sustained service. Current members of the Prairie Chapter Executive Committee are not eligible. The deadline is March 1, 2011. More Information
AVS Congressional Fellow Update

By Chirs Spitzer

The United States Congress is a world in itself, with its own specialized language and intricate customs. Every day, within its halls, decisions are made that have profound impacts on the entire nation. Many of these require a deep understanding of technical and scientific concepts. Yet, many scientists lack the knowledge of the legislative process to make their voices clearly heard, and many lawmakers lack access to unbiased technical expertise.

AVS and the American Institute of Physics are working hard to bridge this gap. This year, I was lucky enough to be selected as the AVS/AIP Congressional Fellow. I am currently a few months in to the Fellowship, advising a Senator on energy and environmental matters. In exchange, I am gaining a great deal of experience in the mechanisms and culture of the legislature.

Initially, I felt like a fish out of water. My academic background, with bachelor degrees in engineering and physics from the University of California at Berkeley, and a Ph.D. in theoretical particle physics from the University of Washington, provided little preparation for the give-and-take of the political realm. After just a few months of working in the office, I feel very comfortable, and have begun to master the skill of communicating with Congress to build support for legislative proposals.

I work in the office of Senator Jeanne Shaheen, a moderate Democrat from New Hampshire. Among other assignments, she holds a coveted position on the Energy and Natural Resources Committee, which has oversight over agencies such as the Department of Energy. This offers me a wonderful chance to help shape efforts on clean energy, which promises to be an active topic this year.

My experience so far has been fantastic. The office has fully embraced having a Ph.D. scientist in the office, and I’ve been able to provide support on issues ranging from the BP oil spill to energy efficiency measures. I was also able to participate in an extremely productive lame duck session, which saw the passage of, among others, the New START nuclear arms reduction treaty, and the COMPETES act, which targets a doubling of NSF and DOE’s basic R&D budgets over ten years.

The first four months of the Fellowship passed in a flash, and now we’re hard at work in the brand new 112th Congress. I’m very much looking forward to injecting a little science into the legislative apparatus.

AVS 2011 Call for Award Nominations Due: March 31, 2011
Do you know people in areas of interest to AVS, should be recognized for?

- 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. Hanvo Award
- Sustained and outstanding technical contributions: Fellow of the Society
- Eminent service to AVS: Honorary Membership

Graduate Student & Divisional Award Nominations:
Deadline: May 4, 2011

Outstanding research by a graduate student: Society Student Awards including several Top Level Awards: Dorothy M. and Earl S. Hoffman Award,
Nellie Yeoh Whetten Award, Russell and Sigurd Varian Award, Dorothy M. and Earl S. Hoffman Scholarships. In addition, Graduate Research Award and numerous Divisional Awards in technical areas of interest to AVS are available.

Beginning in 2010, 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. For details and application forms please visit [www.avs.org](http://www.avs.org).

**New Theodore E. Madey Award for Surface Science and Scientific Exchange**

AVS is pleased to solicit nominations for a prestigious new award, the [Theodore E. Madey Award for Surface Science and Scientific Exchange](http://www.avs.org). This award is named after Professor Theodore E. Madey, who had a distinguished history of scholarship and service to AVS. The applicant must have accomplished outstanding theoretical and/or experimental research of interest to the AVS, with special emphasis on surface processes at a fundamental atomic and molecular level, as well as outstanding leadership at the international level.

For more awards information, please contact Angela Klink, [angela@avs.org](mailto:angela@avs.org).