We encourage feedback and suggestions for the content of future newsletters. We are especially interested in receiving research highlights from CNMS users that may be featured in future issues of this newsletter. Please email us any time you have an important paper that is accepted for publication.

Message from the UEC Chair

Dear CNMS Users, we have two questions for you:

* Have you registered for the CNMS User meeting?
* Would you like to be more involved with the UEC?

We want as many “Yes!” as we can get. The CNMS User meeting registration deadline is rapidly approaching and there is still time for you to register and attend the meeting. For the first time the poster session will be judged with awards presented at the CNMS Town Hall for best student posters.

At the User meeting, we will have an open call for nominations for UEC at-large members and positions (see more details inside this edition). The requirements are given in the by-laws, but most importantly, the nominees must have had an active CNMS project within the past 3 years. A list of eligible users will be provided when the call for nominations is announced. Please feel free to nominate yourself or others directly to us before the meeting or at the meeting. Formal candidate statements will be collected at a later date for the on-line voting.

On June 10th, the UEC represented the CNMS at the 4th annual National User Facility Science Expo for the U.S. House of Representatives in the foyer of the Rayburn House Office Building, Capitol Hill Washington D.C.. Congressional staff and their representatives from more than 37 Congressional offices and 7 House and Senate Committees attended the Expo. The Expo displayed numerous hands-on and video demonstrations, including one from the CNMS Microscopy group, so that the visitors could see the research impacts from User facilities. Dr. Pat Dehmer, the Acting Director of DOE’s Office of Science, attended the event and can be seen along with the NUFO chair and UEC members in the adjacent photo. In addition to
the Expo, three UEC members, Nazanin Bassiri-Gharb, Milan Buncick, and Molly Kennedy, visited 9
different Congressional offices. The purpose of these visits was to share the excitement, im-
portance and necessity of National User facilities, such as the CNMS, for the advancement of sci-
ence, technology, and global competitiveness. For more information please see the National User
Facility Organization (NUFO) web page.

At the close of the past CNMS proposal call, we received 201 new proposals and after technical
reviews approximately 75 % received CNMS approval. We sincerely thank all our reviewers and all
those who participated. The UEC is here to voice your questions and comments and we value your
input. Feel free to contact any UEC members directly or anonymously via “feedback” button on
the CNMS homepage.

Don’t forget to “Thank a CNMS Staff Member”!

Vivek Prabhu
2014 UEC Chair
National Institute of Standards and Technology
Gaithersburg, Maryland

News from CNMS

2014 CNMS User Week

The Center for Nanophase Materials Sciences (CNMS) at Oak Ridge National Laboratory is pleased
to announce plans for the 2014 CNMS User Meeting, to be held on September 17 at Oak Ridge
National Laboratory in Oak Ridge, Tennessee. Featured workshops will be held before and after the
User Meeting during the week of September 15-19. Registration is still open until September 3 (no fee to register) - we hope to see you here in September!

Important Dates

* September 3, 2014: Registration Deadline (no fee)
* September 15-16, 2014: Electrochemical Strain Microscopy workshop
* September 17, 2014: CNMS User Meeting
* September 18-19, 2014: In Situ Electron Microscopy and Imaging workshop

For the complete program and registration information, visit our website.

UEC Election

The User Executive Committee (UEC) consists of the Chair, Vice Chair, Secretary, and 7 at-large
User Representatives, elected to rotating two year terms by the User Community. This year, nomi-
nations for Vice Chair (one year as Vice Chair, one year as Chair) and 4 at-large members (two year
terms) will be accepted.

To make a nomination, send an email to cnms-uec@ornl.gov identifying the nominee(s) and the
office(s) for which you are nominating them (Vice-Chair or At-Large). To expedite your nomination,
it is strongly suggested that you identify another CNMS user who is willing to second the nomina-
tion, CC that member on your nominating email, and ask them to confirm their support by a reply
to cnms-uec@ornl.gov. Nominations will be accepted through the end of the CNMS User Meeting
on September 17, 2014.
Research Highlights

Ezhiylmurugan Rangasamy
Postdoctoral Researcher in the Electronic and Ionic Functionality Group
Process Engineer at Applied Materials Inc.—beginning Fall 2014

“I’m interested in the development of all-solid energy storage devices with increased safety and better performance. Our research is focused on the development of solid-state electrolytes that can integrate seamlessly with high-capacity electrodes thereby offering a very attractive energy storage system. However, seamless integration is not facile, as multiple kinetic limitations at the interfaces have to be overcome. This is achieved through synergies at the different interfaces: at the electrolyte-anode interface to demonstrate chemical stability and favorable interfacial kinetics, within the electrolyte to exhibit fast ion conduction that can cope with the power demands, and at the cathode for favorable interfacial kinetics coupled with the possibility of additional electrochemical capacity. By developing systems with such synergies, we are attempting to demonstrate the immense potential for all-solid-state batteries.

CNMS has excellent expertise in solid-state electrolytes, especially some of the advanced energy storage technologies. Based on my interest in solid state ionics, coming to CNMS was an automatic choice. As a researcher at CNMS, we have direct access to state-of-the-art characterization equipment. Additionally by being a user facility, CNMS gives access to collaborating with researchers across a variety of backgrounds from academia to industries and all across the globe providing an excellent environment to enhance the scopes of a researcher.”

Dr. Ezhiylmurugan Rangasamy was a postdoctoral research associate in the Electronic and Ionic Functionality Group from 2013 until July-2014, mentored by Dr. Chengdu Liang. Before coming to CNMS, he received his Ph.D. in Chemical Engineering from Michigan State University in 2012 under the guidance of Prof. Jeff Sakamoto. For his graduate research Ezhiyl studied the garnet- and perovskite-structured solid-state electrolyte systems for Li-ion batteries. Ezhiyl has just accepted a position as Process Engineer at Applied Materials Inc.

Following is a recent highlight from Dr. Rangasamy’s work at CNMS.

New Chemistry Enables Longer Lasting Batteries

Scientific Achievement
A novel electrolyte for lithium carbon fluoride (Li-CFx) batteries that boosts the specific capacity and extends the lifetime.

Significance and Impact
This breakthrough can potentially provide longer-lived disposable batteries suitable for applications such as implantable medical devices, wearable electronics and remote sensors.

Research Details
- A tandem discharge of CFx and lithium thiophosphate was enabled by lithium fluoride from the discharge of CFx. The observed capacity of the novel solid cell is higher than the theoretical maximum of conventional Li-CFx cells in which the electrolyte does not react.
- The application of a solid electrolyte has resulted in a new solvent-free electrochemical pathway for the Li-CFx system, thereby avoiding the volume expansion and heat generation issues of current generation devices.

E. Rangasamy, J. Li, G. Sahu, N. J. Dudney, and C. Liang, J. Amer. Chem. Soc. DOI: 10.1021/ja5026358
Jonathan Boreyko
Postdoctoral Researcher in the Nanofabrication Group
Assistant Professor at Virginia Tech in the Department of Engineering Science and Mechanics—beginning Fall 2014

“I am interested in designing bio-inspired nanostructured surfaces that can exploit novel phenomena for water, ice, and biological systems. For example, I am trying to engineer nanostructured surfaces that are anti-fogging and anti-frosting by making the surface so water-repellent that condensation spontaneously jumps off the surface as it forms! I am also getting very interested in synthetic biology, and have recently pioneered a new technique that allows for synthetic biological membranes to be suspended in an air environment (to date they have always been submerged in a liquid reservoir). The CNMS theme that I work in is ‘Collective Phenomena in Nanophases,’ I love seeing how the nanoscale topography of a surface can affect the behavior of microscopic droplets, which in turn can govern the macroscopic behavior of phenomena such as condensation and frost growth. Before coming to CNMS, I earned my Ph.D. at Duke University in the Department of Mechanical Engineering and Materials Science under Professor Chuan-Hua Chen. Coming to CNMS was my first choice for my post-doc because I was excited about working in a highly collaborative atmosphere with lots of great equipment. My favorite aspect of working at CNMS was how the group challenged me to learn new fields and techniques while simultaneously encouraging me to pursue my own ideas as well. It also didn’t hurt that nearly everyone in my group loved basketball, we played every Wednesday during lunch! By the end of my two years at CNMS, I used nearly all of the equipment in the clean-room, including photolithography, E-beam lithography, and the scanning electron microscopes. My favorite tool is definitely the goniometer, which measures the surface tension and hysteresis of droplets on surfaces and also captures neat side-view videos of droplet dynamics. In the Fall, I will be an Assistant Professor at Virginia Tech in the Department of Engineering Science and Mechanics. My research theme will be ‘bio inspired fluidic systems,’ and I have already established a CNMS User project so that I can continue to work with the great people and facilities at CNMS.”

Dr. Jonathan Boreyko was a postdoctoral research associate in the Nanofabrication Group from summer of 2012 until July 2014, mentored by Pat Collier. Before coming to CNMS, he received his Ph.D. at Duke University in the Department of Mechanical Engineering and Materials Science under Professor Chuan-Hua Chen. He has accepted a position as an Assistant Professor at Virginia Tech in the Department of Engineering Science and Mechanics which begins this Fall.

Following is a recent highlight from Dr. Boreyko’s work at CNMS.

Air-Stable Droplet Interface Bilayers on Oil-Infused Surfaces

Scientific Achievement
We show that an air-stable droplet interface bilayer can form between non-coalescing water droplets on an oil-infused nanostructured surface.

Significance and Impact
This study is the first demonstration of nanoscale droplet interface bilayers in ambient environments, suggesting new avenues for the self-assembly of complex systems.

Research Details
- Water droplet-droplet interactions were characterized on an oil-infused surface consisting of superhydrophobic silicon nanopillars, fabricated using a lithography-free etching technique.
- The lifetimes of droplet non-coalescence were 1-3 orders of magnitude longer compared to droplets in contact in a submerged oil bath.
- When phospholipids were included in the non-coalescing water droplets, an air-stable droplet interface bilayer was formed that was used to detect single-channel gating events.

Work was performed at the Center for Nanophase Materials Sciences at ORNL.

DOI: 10.1073/pnas.1400381111
Career Opportunities at the CNMS

Visit the [website](#) for more information and links to view open positions as well as other opportunities at ORNL.

CNMS in the News

ORNL study reveals new characteristics of complex oxide surfaces

A novel combination of microscopy and data processing has given researchers at the Department of Energy’s Oak Ridge National Laboratory an unprecedented look at the surface of a material known for its unusual physical and electrochemical properties.

The research team led by CNMS researcher Zheng Gai examined how oxygen affects the surface of a perovskite manganite, a complex material that exhibits dramatic magnetic and electronic behavior. The new avenue to understand surface behavior could benefit researchers who are interested in using a wide range of correlated oxide materials for applications such as solid fuel cells or oxygen sensors.

“It’s like the material has many knobs, and if you turn one, all the properties change,” said Gai. “You turn a different knob and the whole thing changes again. It turns out the surface is another knob -- you can use it to change the properties.”

The team’s results, published in *Nature Communications* and highlighted in [eScience news](#), underscore why the materials are called “strongly correlated.” Because the chemical and physical functionalities are coupled, any minor change can influence the entire system.

Read more CNMS in the News on our [website](#).

Staff Honors

Mike Simpson named ORNL Corporate Fellow

Congratulations to Mike Simpson on being named ORNL Corporate Fellow! The corporate fellow status is ORNL’s highest scientific distinction – there are only 30 active fellows at ORNL and the fellows serve an important role in advising ORNL leadership. Mike is currently group leader for the Nanofabrication Research Laboratory and his current research focus includes noise biology, nano-enabled synthetic biology and controlled synthesis and directed assembly of carbon nanostructures.

Hispanic Engineers recognize Idrobo

Juan Carlos Idrobo has been recognized by the Hispanic Engineer National Achievement Award Corp. with the 2014 Outstanding Achievement Award for groundbreaking research in scanning transmission electron microscopy of 2D materials. Juan Carlos works in the Center for Nanophase Materials Sciences’ Microscopy group.