MST e-NEWS

January 2012

INSIDE

American Physical Society honors Bogdan Mihaila

Bogdan Mihaila has been selected as a Fellow of the American Physical Society (APS).

The APS is a non-profit membership organization working to advance and diffuse the knowledge of physics through its research journals, scientific meetings, and education, outreach, advocacy, and international activities. It represents 48,000 members worldwide, including physicists in academia, national laboratories, and industry. Only half of 1 percent of the APS members can be elected to Fellowship yearly.

Mihaila (Materials Technology –Metallurgy, MST-6), was cited for *"contributions to the development of accurate numerical methods for the study of nonlinearity in many-body theory with applications to cold atom, condensed matter, nuclear, and high-energy physics."*

APS Computational Physics nomination

Mihaila was cited for "contributions to the development of accurate numerical methods for the study of nonlinearity in many-body theory with applications to cold atom, condensed matter, nuclear, and high-energy physics.

Mihaila earned a doctorate in theoretical nuclear physics from the University of New Hampshire, and then he worked as a postdoctoral researcher at Oak Ridge and Argonne National Laboratories. In 2003, Mihaila joined Los Alamos as a postdoctoral fellow in the Theoretical Division. He has been on the scientific staff in the Materials Science and Technology Division since 2006. A many-body theorist by training, his work is focused on diverse topics in condensed matter and materials science. Mihaila is developing state-of-the-art physics-based simulations in support of process modeling and engineering at LANL. He has received the LANL Distinguished Mentor Performance Award, the Institute for Complex Adaptive Matter Senior Fellowship, and he was a Visiting Scholar at the Institute for Nuclear Theory (University of Washington).

Technical contact. B. Mihaila

From Dave's Desk

I would like to welcome everyone back from what was hopefully a relaxing and enjoyable holiday break. MST Division finished the year with several notable accomplishments and here are just a few highlights from the year. MST-16 made significant contributions to several Pu Z-shots providing exciting new results. Scientists and students in MST-6 performed the first ever in situ solidification measurements using proton radiography. A team in MST-8 developed a new approach for optimization of $Lu_3Al_5O_{12}$ garnet-based scintillators using a band-gap engineering approach. Lastly MST-7 had a very successful year developing and producing of targets for several high-energy density experiments and proton radiography experiments. We also established a new exciting capability to perform x-ray nanotomography in MST-7 that can provide nondestructive 3D images of materials down to ~50 nm resolution. Going into 2012 we have just as many exciting and important deliverables and I'm looking forward to helping you accomplish that mission for our customers.

As I wrote this on January 17th, a light layer of snow was coating the sidewalks. By the end of the day 12 people had reported to Occupational Medicine with injuries for slipping on the ice or snow-covered walkways. Although we didn't receive that much snow, the light amount still created a significant slipping hazard. With the thaw/freeze cycle that occurs daily, slick spots in our walkways may still exist even though it has not snowed recently. If you happen to come across a slick area, first tread carefully or consider walking around the slick location if safe to do so. Also, try to take a little time to locate some salt to spread on the ice. The salt bins are located along most of the heavily traveled areas or areas known to have ice issues. If you find an area that chronically has ice issues, please contact the FOD, your local WSST representative, or myself and one of us can arrange to have a salt bin located nearby.

"MST finished the year with several notable accomplishments . . ."

Many of you have expressed concerns about the new intersection at Eniwetok and Diamond Drive and we have discussed some possible actions at our recent ADEPS WSST meeting. Most of the complaints are simply related to poor driving habits and drivers being unaware of pedestrians and bicyclists. I believe the most effective way to correct driving habits is to enforce the traffic laws (note how the recent police presence on the truck route has caused many drivers to slow down). Traffic enforcement on LANL property is challenging, but I have contacted Darren Schnedler, our Directorate security manager, to see what could be done to enforce traffic laws on LANL property, e.g. not yielding to pedestrians. Secondly, the WSST will be looking into whether speed bumps could be installed in the new turn lanes to slow down drivers since they no longer have to stop to turn right. This would hopefully give the drivers a better chance of seeing and yielding to pedestrians. Lastly, I encourage you to take personal responsibility for your own safety. Take extra caution when crossing these intersections. Make eye contact with a driver that has slowed or yielded to allow you to cross. If you have to wait another 5-10 seconds for no traffic to be coming your way, then wait. The bottom line is do not put your safety in the hands of other drivers if you can help it.

Acting MST Division Leader David Teter

Gray presents invited talk at DC materials science and engineering event

Laboratory Fellow Rusty Gray (MST-8) was the invited speaker at the December gathering of Materials DC in Arlington, Va. During the Dec. 14 event, Gray discussed the shock response in lightweight materials and how dynamic properties influence design.

Lightweight materials offer great promise and simultaneously unresolved hurdles to achieving widespread usage in defense systems. While lightweight metals (aluminum, magnesium, and titanium) can facilitate significant weight savings in structural applications, the lack of performance data and predictive capability for dynamic deformation, shock loading, damage evolution, and failure responses of these materials remains a challenge to their utilization in platform and personnel protection applications. Cost, fabrication difficulties, and performance trade-offs also remain barriers. Throughout history, materials for personal protection applications have been selected almost exclusively on the basis of empirical or "hands-on" experience. The ability to engineer the response of metals and alloys to the desired end "performance" or application is an age-old endeavor, extending from the famous fifth-century steels of Damascus to the aluminum alloys that enabled the modern era of civilian aviation. Over the past five decades, the rudimentary coupling of processing know-how and experience with "rules of thumb" has given way to an increasing level of scientific and engineering insights into the dominant mechanisms controlling microstructure development linked to process modeling and thereafter the predictive modeling of the correlations between microstructure, properties, and performance. In this revised approach to a materials design paradigm the focus becomes geared to identifying new materials, microstructures, and processes that are theoretically predicted to meet a set of designer specified performance criteria. In the area of protection this represents a "decadal grand challenge" to engineers and scientists to develop tailored materials based upon a cadre of knowledge founded on scientific mechanisms and the governing physics as opposed to empirical relationships fitted to experimental observations and testing. In his talk, Gray reviewed the state-of-the-art of scientist's understanding of the dynamic deformation responses of aluminum, magnesium, and titanium and discussed progress toward the grand challenges of predictive materials science.

Gray, a past president of TMS, earned his PhD in metallurgical engineering from Carnegie Mellon University. His research interests include the substructure evolution and mechanical response of metals, alloys, intermetallics, and composites as a function of microstructure and applied test conditions. He is a member of the National Materials and Manufacturing Board of The National Academies, is a Fellow of ASM International and a Fellow of the American Physical Society.

An affiliated chapter of ASM International, Materials DC brings together those in the DC area with an interest in materials science and engineering.

Technical contact: Rusty Gray

Sol–gel processing and characterizations of a $Ba_{0.75}Sr_{0.25}Ti_{0.95}Zr_{0.05}O_3$ ceramic

$BaSrTiO_3$ (BSTO) ceramics are unique materials because they possess a dielectric constant that depends strongly on applied electric field, and have low loss at relatively high frequencies (~1 GHz). Because of this, there are many practical applications that these materials can be used for, including tunable RF phase shifters, tunable capacitors, and tunable filters. In addition, there is research at LANL and other institutions to fabricate a nonlinear transmission line (NLTL) from BSTO. An NLTL is a periodic array of BSTO (or some other nonlinear material), which contains both nonlinear and dispersive electric properties. This combination will convert a low frequency, broadband input pulse into a high frequency, narrowband source of RF. Because NLTLs are high power and tunable, they have the potential for many applications in the military and communications fields.

In research appearing in the *Journal of the American Ceramics Society*, researchers in MST-6, the Superconductivity Technology Center (MPA-STC), High Power Electrodynamics (AOT-HPE), and Sandia National Laboratories have successfully developed $Ba_{0.75}Sr_{0.25}Ti_{0.95}Zr_{0.05}O_3$ (BSTZO) powders using the sol–gel synthesis method. These sol-gel synthesized powders offer advantages like low temperature synthesis, ease in controlling the composition variations, high surface area, and potential use in film processing. The single-phased BSTZO powders were hot-pressed at 1300°C and 3000 psi for 2 h in an argon environment. Figure 1 is the XRD patterns, which show a complete single phase $BaSrTiZrO_3$ after hot-pressing. From this diffraction pattern, it is easy to see that the hot-pressed sample has maintained the single phase at 1300°C. No other phase was detected from this hot-pressed pellet. SEM micrograph shows that the hot-pressed BSTZO has a high density with very few pores.

The bias dependence of the dielectric constant is shown in Fig. 2. The figure shows the dielectric constant as a function of the bias

continued on page 4

Processing... field at several different temperatures. All the results are in the ferroelectric state at temperatures slightly below Tc. Some of the field curves show an offset, where the relative dielectric constant (εr) peaks at non-zero field. This is common in the ferroelectric state, where internal bias fields may be present. The tunability of the dielectric constant with field is ~30% over this relatively narrow field and temperature range.

Reference: "Sol–Gel Processing and Characterizations of a $Ba_{0.75}Sr_{0.25}Ti_{0.95}Zr_{0.05}O_3$ Ceramic" *Journal of the American Ceramics Society,* **94** [11] 3727–3732 (2011) by Ching-Fong Chen, (MST-6), David W. Reagor (MPA-STC), Steven J. Russell, Quinn R. Marksteiner, Lawrence M. Earley, and Dale A. Dalmas (all AOT-HPE), Heather M. Volz (MST-6, now with N-3), and Dennis R. Guidry and Pallas A. Papin (MST-6), and Pin Yang (Sandia National Laboratories). This program was financially supported by the Joint Non-Lethal Weapons Directorate (JNLWD) through the Office of Naval Research, contract #N0001409IP20094 to Los Alamos National Laboratory.

Technical Contact: Chris Chen

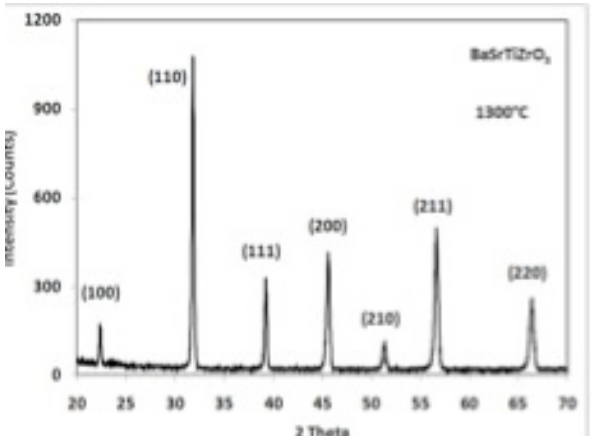

Figure 1: XRD showing a single phase $BaSrTiZrO_3$ for sample hot pressed at 1300°C for 2 h.

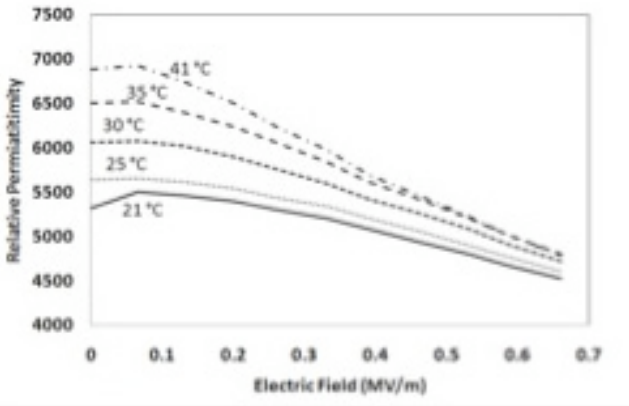

Figure 2: The bias dependence of the dielectric constant at various temperatures.

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Published monthly by the Experimental Physical Sciences Directorate.
To submit news items or for more information, contact Karen Kippen, EPS Communications, at 606-1822, or kkippen@lanl.gov.

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To read past issues, please see www.lanl.gov/orgs/mst/mst_enews.shtml.

Celebrating service

Congratulations to the following MST Division employees celebrating service anniversaries this month:

Joel Katz, MST-6 25 years
George Kaschner, MST-16 15 years

HeadsUP!

Call issued for 2012 pollution prevention award nominations

The Lab is now accepting nominations for 2012 pollution prevention awards. P2-related projects and activities that have reduced pollution, enhanced operations, saved money, or reduced environmental impacts are eligible for nomination. Nominations are due by the end of the work day on February 10.

The official nominating form and instructions are online. Winners will be recognized at an awards ceremony on Earth Day, April 19. LANS and subcontractor personnel (individuals or teams) who completed projects in 2011 are eligible to be nominated.

Questions? Contact the Pollution Prevention Program Office at 5-8855 or p2awards@lanl.gov.

Coming soon: Los Alamos's Environmental Recertification Audit

The "ISO 14001 Environmental Recertification Audit" will occur February 13 -17. Most likely it will touch every corner of the Laboratory, including divisions associated with ADEPS. This column is meant to provide you with basic information as to what the audit is all about and what important things you should know. E-mail updates will be forwarded to our divisions as final audit plans and schedules become available.

First and foremost, please consider familiarizing yourself with the LANL EMS webpage off the LANL home page (click on the "Environment" tab at the top of the page); as with most audits, workers are not always expected to know every policy, detail or plan – but- they should know how to find them!

Each worker should be able to:

- Describe their role and function at LANL,
- Discuss how their work may interact with the environment (directly and indirectly), and
- Explore what steps they take or could take to improve environmental performance.

Each worker should be able to describe/able to find:

- Laboratory Environmental Governing Policy, which states:

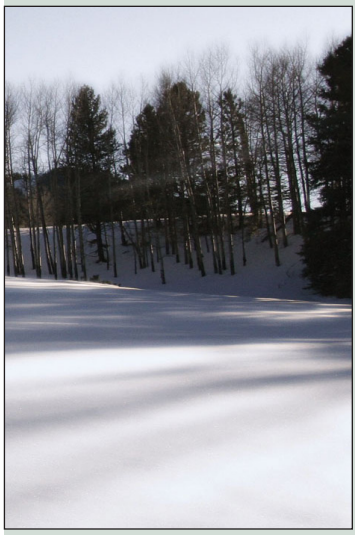
"We approach our work as responsible stewards of our environment to achieve our mission. We prevent pollution by identifying and minimizing environmental risk. We set quantifiable objectives, monitor progress and compliance, and minimize consequences to the environment, stemming from our past, present, and future operations. We do not compromise the environment for personal, programmatic, or operational reasons."

- Their EMS point-of-contact:

ADEPS POCs: MST – Jim Coy; MPA – Cathy Padro; LANSCE – Frances Aull; Physics – Steve Glick

- Their EMS Environmental Action Plan actions (if they have actions):

The FY12 ADEPS EAP and much more can be found within the Lab's EMS Web page at int.lanl.gov/environment/ems/index.shtml.



'Most likely (the audit) will touch every corner of the Laboratory, including divisions associated with ADEPS.'

More information on our FY12 Environmental Action Plan and the various actions certain individuals will need to take will be distributed shortly.

- Their current/up-to-date work procedures

- Any measuring and testing equipment used in activities that may interact with the environment and the associated M&TE calibration records

- Their environmental records:

It is strongly encouraged that all staff have their required Environmental Awareness Training (#32461) completed; annual refresher course (#52121) is also available in UTrain.

Each manager should be able to describe:

- Their organization's activities that may interact with the environment,
- Their management role in activities that may interact with the environment,
- Their commitment to the Laboratory Governing Policy and their EMS EAP,
- Examples of improvements to their organization's environmental performance, and
- Outcomes of the management review of the EMS and previous year's EAP (this can be found at the LANL EMS Web page at int.lanl.gov/environment/ems/index.shtml, under the Directorate Achieves link, click on ADEPS, then on FY11 TR 5.2 to find the review document).

The EMS program at LANL conforms to the ISO 14001 standard as required within the LANL/NNSA Prime Contract with the DOE. The specific requirement calls for an independent third-party recertification audit of the entire organization once every three years.

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). International Standards covering environmental management are intended to provide organizations with the elements of an effective environmental management system (EMS) that can be integrated with other management requirements and help organizations achieve environmental and economic goals.

Steve Glick, ADEPS EMS point of contact