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MST e-NEWS

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INSIDE

Nominated by their peers, Thomas Lienert (left) and David Alexander (right) will be inducted as ASM International Fellows at MS&T'13 this month in Montreal, Canada.

Materials science and engineering excellence

Alexander and Lienert named ASM International Fellows

David Alexander and Thomas Lienert (Metallurgy, MST-6) are among ASM International's 2013 Class of Fellows, who are honored for their distinguished contributions to materials science and engineering.

A total of nine ASM Fellows have come from Los Alamos over the years, according to the society, which is commemorating its 100^{th} anniversary.

The citation for Alexander reads: "For excellence in the understanding of deformation processing and effects of in-service conditions on microstructure/property relationships through novel testing techniques and innovative processing routes in a wide variety of structural materials."

Alexander, who has a PhD in metallurgy from Carnegie-Mellon University, joined Los Alamos in 1998. He leads MST-6's Forming and Machining Team, which is responsible for processing, fabricating, and machining materials and components for numerous customers at Los Alamos National Laboratory, in both weapons-related and non-weapons programs.

In 2011, Alexander won two NNSA Defense Programs Awards of Excellence for electro spark deposition development on the Nondestructive Laser Gas Sampling team and for deformation physics-based uranium component modeling on the PREDICT team. In 2012, Alexander was part of a team that won two in-house awards for the Nondestructive Laser Gas

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From David's desk . . .

"Perhaps the most positive impact was the exposure I had to passionate, volunteer leaders ... Often our communities have very passionate volunteers that could have an even greater impact if they had more resources."

"I Give Because…"

As we enter the holiday season, I find it useful to reflect on how we can support the organizations that help build stronger communities. Depending on our personal circumstances many of us donate time, talents, and funds to charitable organizations. In November, the Laboratory is kicking off the annual United Way Employee Giving campaign with the theme "I Give Because…" I'll admit that although I support local organizations through the United Way, I had never really stepped back to reflect on why "I Give … " to the United Way organization. So I thought I would share with you why I give back to the community.

I grew up in Aurora, Illinois, near Chicago. Thinking back to my childhood, I recognize that I had several opportunities to take the wrong path. Several of my childhood friends got involved with drugs, gangs, and crime. Luckily, I had a very supportive family and many community-based organizations that gave me opportunities for positive activities such as church, scouting, athletics, and music. Without this support network, I could have had a very different path in my life. Perhaps the most positive impact was the exposure I had to passionate, volunteer leaders in many of these activities. Often our communities have very passionate volunteers that could have an even greater impact if they had more resources. I believe our future is very dependent on the health, energy, and passion of our youth and that our local communities have many different organizations that help build our youth to become active positive members of our community.

I ask you to reflect on this year's theme "I Give Because…" and consider donating to the United Way this year. Many options exist allowing you flexibility in either designating specific charitable organizations that you would like to support or donating to the general fund that United Way manages. LANS covers all of United Way administrative costs, so 100% of your donation will go to the nonprofit organizations you choose. You may also designate to your favorite 501(c)(3) nonprofit organization(s) even if it is not listed.

Please join me in pledging to give to the United Way this year to help build stronger communities. For more information please go to giving.lanl.gov.

MST Division Leader David Teter

ASM cont.

Sampling project, as well as an R&D 100 Award from *R&D Magazine* for Valveless Laser Processing. He holds two patents. Alexander chairs the Metallurgical and Materials Transactions Joint Commission, an advisory panel for one of the premier archival journals for metallurgical and materials research.

The citation for Lienert reads: "For sustained impact and pioneering advancements in welding metallurgy and welding process understanding."

Lienert, who holds a PhD in Materials Science and Engineering from The Ohio State University, is a staff member in MST-6's Welding and Joining team, the largest precision welding group of its kind in the DOE weapons complex. He joined the team in 2002. He was a recipient of a 2011 NNSA Defense Programs Award of Excellence and a 2011 LANL Distinguished Performance Award for his efforts on the Nondestructive Laser Gas Sampling project. Lienert played a key role in modernizing the laser system at Technical Area 55 with a new Yb-fiber laser welding system and was the driving force behind the development of the Valveless Laser Processing project, which won a 2012 R&D 100 Award from *R&D Magazine*. Lienert is a fellow of the American Welding Society, as well as a Director-at-Large and a member of its Board of Directors.

Lienert was awarded the 2004 McKay-Helm Award for the most valuable paper relating to joining of steels and stainless steels and the 1999 Charles H. Jennings Memorial Award for the most valuable university research paper for publications in the Welding Journal Research Supplement.

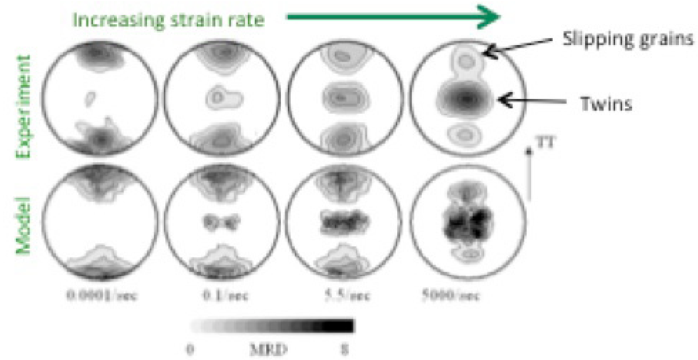
Nominated by their peers, ASM Fellows receive final approval from the Board of Trustees. Alexander and Lienert will be inducted as fellows in October at MS&T'13, the Materials Science & Technology 2013 conference in Montreal, Canada. ASM International has 36,000 members worldwide and a mission to disseminate information on materials and processes.

Technical contacts: David Alexander and Thomas Lienert

Rate-dependent deformation mechanisms in beryllium

Los Alamos National Laboratory scientists have developed and validated physics-based constitutive models of the deformation of beryllium, allowing for predictive computer codes that simulate how materials perform under conditions that cannot be reached experimentally.

Beryllium has applications for the aerospace industry, nuclear energy, and nuclear weapons. The technique of characterizing the twinned microstructure also has had an



Experimental/model agreement achieved over 7 orders of magnitude in strain rate and 3 different starting textures.

impact on research in magnesium, zirconium, and other low-symmetry metals, which are relevant to the automotive and nuclear power industries, for example.

At the Lujan Neutron Scattering Center, scientists used data collected on the Spectrometer for Materials Research at Temperature and Stress (SMARTS) and the High Pressure – Preferred Orientation (HIPPO) diffractometer to characterize the deformed microstructure.

Experiments were carried out over 7 orders of magnitude in strain rate. Three different starting textures provided strong validation for the constitutive model developed in the Theoretical Division. Deformation twinning goes from inactive at quasi-static rates to an important deformation mode at a rate of 5000/sec.

Researchers include Don W. Brown, Thomas A. Sisneros, Bjorn Clausen, Carlos Tome (Materials Science in Radiation and Dynamics Extremes, MST-8) and Irene Beyerlein (Fluid Dynamics & Solid Mechanics, T-3).

Reference: "Coupled Modeling and Experimental Program on SMARTS and HIPPO Uncovers Rate Dependent Deformation Mechanisms in Beryllium," *International Journal of Plasticity*, **29** (2012).

This work benefited from the Lujan Neutron Scattering Center at Los Alamos Neutron Science Center, funded by the DOE Office of Basic Energy Sciences and Los Alamos National Laboratory under DOE Contract DE-AC52-06NA25396.

The work supports the Advanced Scientific Computing initiative by providing model validation data.

Technical contact: Don Brown

Modeling void growth in polycrystalline materials

The failure of structural materials has a significant impact on vast sectors of the economy. Most metallic structural materials are polycrystalline aggregates, in which the constituent crystals are irregular in shape, have anisotropic mechanical properties, and contain a variety of defects, resulting in very complicated mechanical responses.

While practical experience and post-failure analysis have given engineers insight into general aspects relating to material processing and performance, failure models remain empirically calibrated because scientists have yet to achieve a thorough understanding of the controlling processes at the scale of the materials' heterogeneity, i.e., the mesoscale.

Recent work by Ricardo Lebensohn (MST-8) and colleagues has led to a novel formulation for a microstructure-aware, three-dimensional, mesoscale prediction of ductile damage processes in polycrystalline metals.

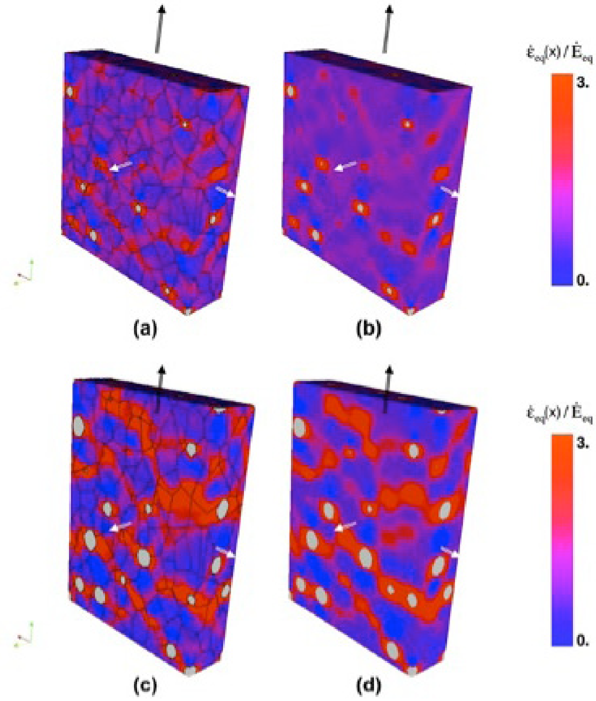
Using a method based on fast Fourier transforms, Lebensohn and collaborators predicted the growth of intragranular voids in a porous solid. This new method, which has been validated against experiments, captures the influence of microstructural characteristics, such as local Taylor factor, on void growth and coalescence. This new work is a significant advancement toward a physically based, process-aware damage model. Modeling microstructural effects on void growth is part of an overarching effort to formulate a truly predictive failure model of structural materials.

A combination of LDRD-DR and Joint DoD/DOE Munitions Technology projects, and the Exascale Co-Design Center for Materials in Extreme Environments (ExMatEx), funded this work.

This research is aligned with the Laboratory's Nuclear Deterrence and Global Security missions and Materials for the Future science pillar.

Reference: "Modeling void growth in polycrystalline materials," by Ricardo A. Lebensohn, Juan P. Escobedo, Ellen K. Cerreta, John F. Bingert (MST-8); Darcie Dennis-Koller (Shock & Detonation Physics, WX-9); and Curt A. Bronkhorst (Fluid Dynamics & Solid Mechanics, T-3), *Acta Materialia* **61**, 6918-6932 (2013).

Technical contact: Ricardo Lebensohn



3-D relative equivalent strain rate fields predicted with the dilatational viscoplastic (D-VPFFT) model, in the cases of a fcc polycrystal with intergranular cavities (left), and a porous material with homogenous isotropic matrix (right). (a-b) Initial (1% porosity), (c-d) final (11% porosity) snapshots. The differences, analyzed in the paper, allowed understanding microstructural effects on void growth.

Herrera and Rittman earn honors at 2013 Student Symposium

In recognition of their research, two Materials Science and Technology Division students received certificates of award at the 13th annual Student Symposium.

In "The Role of Interfaces on Shock-Induced Damage in Two-Phase Metals: Copper-Lead," poster presentation winner Alicia H. Herrera investigated high purity copper and copper with 1 wt-% lead. Herrera (MST-8), an undergraduate student from the University of California, Davis, was mentored by MST-8 Deputy Group Leader Ellen Cerreta.

For ductile metals, dynamic fracture during shock loading is thought to occur through void nucleation, growth, and then coalescence, that eventually leads to material failure. Particularly for high purity metals, it has been observed by numerous investigators that under incipient spall conditions, voids appear to deterministically nucleate at some grain boundaries, but not others. However, for materials of engineering significance, those with inclusions, second phase particles, or chemical banding, the role of grain boundaries versus other types of interfaces in damage nucleation is not well understood. In this study the addition of Pb, which seg-

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HeadsUP!

Form 1897PA required for photography

Workers are reminded that photographic equipment must be authorized through submission of Form 1897PA, Photographic Equipment and Activity Authorization, before being used for photographic activity on LANL property. As controlled articles, cameras, video records, and other photographic equipment have additional requirements for use at LANL. For more information, please see Controlled Articles, P217.

Contact your ESO if you have a recalled Soleil portable fan heater

If your office or work space has a Soleil portable fan heater, please immediately remove it from service and contact your electrical safety officer (ESO) to get a replacement. The 750/1500-watt heaters were recalled after consumers reported that the plastic housing can melt, deform, and catch fire during use, posing a fire hazard. Look for model number LH-707 on a sticker fixed to the bottom of the fan. For more information see www.homedepot.com and click on "Product Recalls."

MST ESOs are

- Dom Peterson, Division ESO
- Greg Gravener, MST-6
- Kevin Henderson, MST-7
- Carl Cady, MST-8
- Michael Ramos, MST-16

Snakes in an office? In late October?

Although snakes are returning to their dens, many are finding them destroyed due to last month's flooding. Now seeking a home to shelter in through the winter, they can be active at an unexpected time of year. For example, a prairie rattlesnake was recently found inside a Laboratory building. Until the snow falls and stays a while, don't assume snakes are gone.

Symposium cont.

regates to triple points and grain boundaries, promotes void nucleation. However, the relatively easy activation of plastic processes in the softer Pb-phase as compared to the Cu matrix acts to dissipate energy necessary to promote void growth.

In "Thermophysical Properties of Stoichiometric CeO_2," technical talk winner Dylan Rittman (Polymers and Coatings, MST-7) sought to lay the groundwork for modeling the behavior of mixed oxide (MOX) nuclear fuel. Cerium dioxide (CeO_2) is commonly used as a surrogate material for PuO_2, which is costly and difficult to work with. Rittman experimentally determined the thermal conductivity (λ) of stoichiometric CeO_2 for the first time up from room temperature to 1500°C. He took temperature-dependent measurements of the thermal diffusivity, specific heat capacity, and thermal expansion that were used to determine thermal conductivity and fitted to a conventional phonon scattering model. The thermal conductivity of CeO_2 was then compared to that of PuO_2 in order to determine the limitations that must be considered when CeO_2 is used as a substitute for PuO_2 during experimental studies of candidate nuclear fuels. An undergraduate student from the University of Michigan, Rittman was mentored by Andrew Nelson (MST-7).

This year's symposium, "Championing Scientific Careers," featured 135 posters and 35 technical talks and was held as part of the Employee Family Celebration. Employee volunteers judged the posters and technical talks.

Celebrating service

Congratulations to the following MST Division employees celebrating a service anniversary recently:

Barry Bingham, MST-6 .... 30 years
David Alexander, MST-6 .... 15 years
Deanna Capelli, MST-7 .... 15 years
Robert Forsyth, MST-6 .... 10 years
Christopher Stanek, MST-8 .... 10 years
Cynthia Welch, MST-7 .... 10 years
Osman Anderoglu, MST-8 .... 5 years

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To submit news items or for more information, contact Karen Kippen, ADEPS Communications, at 505-606-1822, or kkippen@lanl.gov.

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

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