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Organization: Min Met & Mater Society

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Title:

Neutron and X-Ray Studies of Advanced Materials V: CENTENNIAL Symposium

Executive Summary

The Neutron and X-Ray Studies of Advanced Materials V:CENTENNIAL Symposium brought together experts, young investigators, and students from this sub-discipline of materials science in order for them to share their latest discoveries and develop collaborations. This annual symposium, which is organized by The Minerals, Metals, and Materials Society, is an important event for this community of scientists. This year, over 100 high-level technical talks were delivered over the course of the four day event. In addition, the large number of students and young investigators in attendance ensured the maximum benefit to the next generation's work force in this area of study.

The science surrounding the utilization of neutrons and x-rays to study advanced materials is becoming increasingly important in increasing the understanding of how the exceptional materials properties of such materials arise. In particular, x-rays and neutrons can be used to visualize material structures at an extremely high resolution and in some cases, three dimensions—allowing unprecedented insights into the mechanisms governing certain materials properties such as strength and toughness. Moreover, some of these techniques allow materials to be visualized without damaging the material, an approach known as non-destructive evaluation. This allows materials to be studied in 3 dimensions while undergoing change in real time which represents an important (and long sought-after) advancement in materials science.

The types of interactions afforded by this event are beneficial to society at large primarily because they provide opportunities for the leaders within this field to learn from one another and thus improve the quality and productivity of their investigations. Additionally, the presence of young investigators and students with technical interests in this field provides promise that the United States will continue to be a leader in this area. The support provided by the Department of Energy for this event directly enhanced its impact on the field by allowing a number of students, young investigators, and technical experts attend and participate in this event who may have otherwise been unable to attend.

Project Accomplishments

The "Neutron and X-ray Studies of Advanced Materials V" symposium, held at the TMS 2012 Annual Meeting & Exhibition in Orlando, Florida (March 11-15, 2012) was a great success. At this symposium, more than 100 talks were delivered over the course of eight sessions, spanning three and one half days. Many of these talks were delivered by invited experts or students. In addition, several poster presentations from this symposium were included as part of the TMS 2012 Annual Meeting & Exhibition poster sessions.

The intent of this specific symposium was to bring together experts in the field to present the latest developments on the science surrounding neutron and x-ray scattering techniques for advanced characterization and investigation. Thanks to support provided by the Department of Energy, Office of Basic Energy Sciences, the symposium also hosted a number of students and young investigators that otherwise may not have been able to attend. Registration support was provided to seven students, two post-doctoral researchers, two young faculty, and three special attendees. In addition, partial travel support was provided to three students. This sponsorship from the Department of Energy was publically acknowledged to the audience of neutron and x-ray experts and students at the beginning of each session.

The following table shows the grant budget categories for this award and the number of individuals supported using the grant funds. As seen in the table, the budget specifications were duly met.

Full Budget Request: $6,690	# Supported
Partial Lodging/Travel Reimbursement for 3 students and/or post docs	3
Registration waivers for 6 students	7
Registration waivers for 2 post docs	2
Registration waivers for 2 young investigators (less than 5 years out from PhD)	2
Registration waivers for 2 select authors (or equivalently, waiver of ½ the cost of registration for 4 select authors)	3

This symposium proved to be a valuable experience for students, junior investigators, and seasoned researchers alike. A number of positive comments came from attending scientists about the high quality of the symposium presentations. Comments included statements such as "this symposium is the best mix of structural, dynamical and crystallography studies performed with neutron and X-ray diffraction." Due in part to support from the Department of Energy many young scientists, students and post-docs attended the symposium. Sign-in sheets were distributed throughout the auditorium at each session which revealed that at each session there were on average about 15-20 young scientists, students and postdocs in the audience.

Project Activities

This symposium was partially supported by DOE funding. The DOE grant being reported here, DOE grant 1215989, offset the conference attendance expenses of students and young investigators in order to maximize the symposium's impact on the work force of the next generation and note-worthy authors and attendees in order to maximize the advanced technical quality of the symposium.

This symposium brought together research experts and students with interests in the characterization techniques and applications of neutrons and x-rays, particularly as they pertain to understanding the properties and mechanisms of advanced materials. A strong technical program, containing over 100 presentations was developed and organized around the following technical sessions. The chairs of the symposium sessions are listed as well. The strong list of session chairs and invited speakers contributed to the high quality of technical content.

- **Monday** (a.m.): *Von Laue, Bragg and Diffraction Centennial:*
  Wolfgang Pantleon, Risoe National Laboratory (Session Chair)
  Xun-Li Wang, SNS (Session Chair)
- **Monday** (p.m.):*In Honor of Dr. Gabrielle Long:*
  Lyle Levine, National Institute of Standards and Technology (Session Chair)
  Andrew Allen, National Institute of Standards and Technology (Session Chair)
- **Tuesday** (a.m.): *In Honor of Professor G. Kostorz:*
  Bernd Schoenfeld, ETH (Session Chair)
  Bennett Larson, Oak Ridge National Laboratory (Session Chair)
- **Tuesday** (p.m.): *Dislocations, Strains, Deformation I:*
  Matteo Leoni, University of Trento (Session Chair)
  Davor Balzar, University of Denver (Session Chair)
- **Wednesday** (a.m.): *Alloys, Correlations, Phase Transitions:*
  Brent Fultz, California Institute of Technology (Session Chair)
  Miguel Castro-Colin, Max Planck Institut Fuer Intelligente Systeme (Session Chair)
- **Wednesday** (a.m.): *Local Structure from Diffraction:*
  Emil Bozin, Brookheven National Laboratory (Session Chair)
  Yuri Melnichenko, Oak Ridge National Laboratory (Session Chair)
- **Wednesday** (p.m.): *Three Dimensional Studies:*
  John Budai, Oak Ridge National Laboratory (Session Chair)
  Leyun Wang, Mississippi State University (Session Chair)

- **Thursday** (a.m.): *Dislocations, Strains, Deformation II:*
  Peter Liaw, University of Tennessee (Session Chair)
  Klaus-Dieter Liss, Australian Nuclear Science and Technology Organization (Session Chair)

As mentioned above, many of the talks were delivered by invited experts in this field. This proved invaluable for other researchers, especially students as it created a strong educational experience. Some of the notable speakers who presented at this symposium included:

- Prof. Gernot Kostorz, ETH Zurich
- Prof. Julia Weertman, Northwestern University, recipient of Von Nippel Award from the Materials Research Society, USA
- Prof. Tamas Ungar, University of Budapest, Hungary
- Prof. Helena Van Swygenhoven Paul Scherrer Institute, Swiss
- Prof. Takeshi Egami, Joint Institute for Neutron Science Oak Ridge UT-ORNL Distinguished Scientist USA
- Prof. Richard Welberry, Research School of Chemistry, Australia
- Prof. Raj Vaidyanathan, UCF, USA
- Dr. Andrew Allen, NIST USA
- Prof. Masato Ohnuma, National Institute for materials science, Japan
- Prof. Paolo Scardi, Chair of Materials Science, Head of the Doctoral School of Materials Science Engineering Department of Materials Engineering and Industrial Technologies, University of Trento, Italy
- Prof. Peter Mullner, Boise State University, USA
- Prof. Philip Withers, Director of the research Unit for Residual Stress and Damage Characterization, University of Manchester, UK. Awarded by prizes from the Royal society of London, Institute of Materials and the Federation of European Materials Societies
- Prof. Dr. Michael J. Zehetbauer, University of Vienna, Chair Group Physics of Nanostructured Materials, Faculty of Physics, Wien, Austria
- Dr. Thomas Proffen, Powder Diffraction Group Leader, Distinguished R&D Staff, Neutron Scattering Sciences Division, Oak Ridge National Laboratory.
- Dr. Klaus-Dieter Liss, The Bragg Institute, Department head, ANSTO, Australia.
- Dr. Henning Poulsen, Risoe National Laboratory/Technical University, Denmark.
- Dr. Seong, Baek Seok, General Manager of the Industrial Program at Hanaro Reactor in South Korea.

The support provided by the Department of Energy for this event proved to be highly valuable to the success of the symposium in that it contributed to a strong attendance of students, young investigators, and special attendees.

Publications: Conference Proceedings

A number of papers from this symposium were submitted to the journal, Metallurgical and Materials Transactions A. The symposium papers that are accepted by the journal review board will be grouped and published together. These papers will then be available in print or digitally within the Metallurgical and Materials Transactions A journal via the publisher Springer at www.springerlink.com.