Track 1:
Dynamic Behavior of Materials

Organized by: Vijay Chalivendra, University of Massachusetts Dartmouth; Bo Song, Sandia National Laboratories; Daniel Casem, U.S. Army Research Laboratory

Sponsored by the SEM Dynamic Behavior of Materials Technical Division

Welcome to Mohegan Sun and the 2011 SEM conference track on "Dynamic Behavior of Materials." This track represents an ever growing area of broad interest to the SEM community, as evidenced by the increased number of papers and attendance in recent years. This track was initiated in 2005 and reflects our efforts to bring together researchers interested in the dynamic behavior of materials and structures, and provide a forum to facilitate technical interaction and exchange. The sessions within this track are organized to cover the wide range of experimental research being conducted in this area by scientists around the world. A modeling session is also included in the 2011 program. The following general technical research areas are included:

- Composite Materials
- Dynamic Failure and Fracture
- Dynamic Materials Response
- Novel Testing Techniques
- Low Impedance Materials
- Metallic Materials
- Response of Brittle Materials
- Shock and Blast Loading
- Optical Techniques for Imaging High Strain Rate Material Response
- Simulation & Modeling of Dynamic Response & Failure
- Dynamic Response of Transparent Materials

The contributed papers span numerous technical divisions within SEM. It is our hope that these topics will be of interest to the dynamic behavior of materials community as well as the traditional mechanics of materials community.

The track organizers thank the authors, presenters, organizers and session chairs for their participation and contribution to this track. We are grateful to the SEM TD chairs who co-sponsored and organized sessions in this track (e.g., Composite Materials, Optical Techniques for Imaging High Strain Rate Events). The SEM support staff is also acknowledged for their devoted efforts in accommodating the large number of submissions this year, resulting in the successful 2011 Dynamic Behavior program you will experience.

The track will commence on Monday morning with the following Keynote Presentation, and continue with a full program through Thursday afternoon. Enjoy the conference!

Keynote Presentation:

Veli-Tapani Kuokkala

Tampere University of Technology

Monday, June 13 • 10:30 AM • Session 6

Temperature Control and Strain-rate Change Techniques in Kolsky Bar Testing

Hopkinson Split Bar, or Kolsky bar, is the most commonly used device for the determination of dynamic material properties in the strain rate range 102...104 s-1. Various constructions have been presented over the years to allow testing in compression, tension, torsion, and shear. At room temperature and constant strain rate, the dynamic mechanical properties of most materials can now be relatively easily determined with these techniques. For many reasons it is, however, increasingly important to know also how the material responds to dynamic loadings at elevated and/or subzero temperatures. In a compression test, where the specimen is simply pushed against the pressure bars to allow transmission of the loading wave from the input bar to the output bar, two basic approaches for high temperature testing are possible: heating the bars or short sections of them together with the specimen, or heating only the specimen and manipulating the bars and the specimen mechanically to accomplish the testing. In tension and torsion, however, the latter technique is not generally possible because the specimen has to be permanently fixed to the bars before the arrival of the loading pulse. In high temperature testing the heating time may also be an important issue, because prolonged stay at high temperatures may result in changes in the material's microstructure and thus affect the obtained results. In such cases, a rapid heating method is needed. At subzero temperatures, either of the above mentioned basic techniques can be adopted for cooling because the temperature difference is not so large and most of the microstructural changes are suppressed. The strain rate sensitivity of the material is usually taken as the change in the flow stress corresponding to a certain constant strain measured at different constant strain rates. This apparent strain rate sensitivity, however, does not take into account the strain rate dependent strain hardening of the material, i.e., the possible changes in the microstructure during straining. To obtain the instantaneous strain rate sensitivity of the material for a constant microstructure, a strain rate jump test can be done, where the strain rate is suddenly either increased or decreased during the test. Various techniques to accomplish the strain rate jump can be employed, depending on the jump magnitude and the strain rate range in question. In this presentation, different techniques used at TUT for high and low temperature dynamic tests as well as for strain rate jump tests in compression and tension are presented and discussed. Also several examples of test results obtained with these techniques, especially for materials that are thermally or mechanically metastable, are presented and discussed.

Veli-Tapani Kuokkala, MSc (Eng.) 1977, Lic. Techn. (PhD) 1981, Dr. Techn. 1984 from Tampere University of Technology, Finland. Professor of Materials Science at TUT from 1997, Head of the Department of Materials Science from 2008. Visiting Scientist at ETH, Zurich, 1983, Long Term Visiting Staff Member at Los Alamos National Laboratory, 1989-90, Visiting Scholar at Purdue University, 2007-08. Member of the Governing Board of DYMAT from 2006. Current research interests: dynamic behavior of (metallic) materials, development of high strain rate experimental techniques, impact and abrasive wear of materials. Authored and co-authored over 130 publications in refereed journals, conference proceedings, and invited presentations.