Neutron Stress, Texture, and Phase Transformation for Industry
SYNOPSIS

Meeting the needs of industry and universities and aiding American economic competitiveness are important to the ORNL neutron scattering community and the Spallation Neutron Source and the High Flux Isotope Reactor. These ORNL user facilities and the state-of-the-art user facilities at other national laboratories funded by the U.S. Department of Energy are shared with the science community worldwide and offer some technologies and instrumentation that are available nowhere else. Each year, these facilities are used by thousands of researchers from universities, other government agencies, and private industry. The new capabilities at HFIR and SNS will greatly expand the impact of neutron scattering.

Neutron diffraction is an important scientific technique used to determine the structures and lattice spacings of materials. Neutron diffraction, like X-ray diffraction, uses the spacings of the atomic lattice as an intrinsic gage of the state of strain of an engineering component. In addition neutrons are very penetrating and tests may be performed on through thicknesses of steel as large as 6cm and much greater for aluminum. Proprietary contract research for industry has been carried out since the 1980's with this technique. Standard test procedures for measuring lattice strain and computing stress were developed by the international neutron community through the VAMAS (Versailles Agreement on Measurements and Standards) organization. The international standard (ISO/TS21432) entitled "Non-destructive testing-Standard test method for determining residual stresses by neutron diffraction" was adopted in Europe in 2005. Research with neutron diffraction is ongoing primarily in Canada, Germany and Japan. Tests have been carried out world-wide since the 1980's in many areas such as: joining technology (welding, riveting, gluing), castings and forgings, nuclear components (welds, pressure tubes, as-irradiated components), aircraft parts(landing gear, wing stiffeners, turbine discs) line-pipe and steam generator tubing. Materials include steels (ferritic, austenitic, and multiphase), aluminum, zirconium and titanium, beryllium, ceramics and composite materials.

The program of the NST^2 Workshop has been developed to expand the awareness of North American industry to applications of neutron scattering and to receive feedback from industry interested in engineering diffraction. A companion event to NST^2, an educational symposium sponsored by the Oak Ridge-Knoxville chapter of ASM International on April 18th 2007 will devote a full day to theory and practical applications of neutron scattering. The NST^2 Workshop has two important segments beginning with an overview session providing an international perspective of the contributions of neutron facilities currently serving industry and utilizing engineering diffraction techniques. The poster session at lunch time will provide an opportunity to learn more the research carried out at these neutron facilities in the U.S. and overseas as well as to continue discussions about specific needs of industry attendees. Presentations by speakers affiliated with industry will follow; these will describe relevant ongoing research currently that is assisted by the information made available by neutron scattering.

The final session of NST^2 will begin with brief descriptions of the two ORNL engineering diffraction instruments, VULCAN at the Spallation Neutron Source and the Neutron Residual Stress Facility at the High Flux Isotope Reactor. This will lead into the most important segment of the program — a dialog between ORNL staff and the industry participants focusing on topics of interest to industry. This may include the following: methods of access to these ORNL facilities, agreements on intellectual property, and the review process of proposals. It might also include discussion relating to the specific needs of industry performing experiments, including sample sizes at realistic operating conditions, and data analysis. The feedback received will be compiled into a report used in identifying elements of an agenda for future research and investment.