

VULCAN – THE DIFFRACTOMETER AT THE SNS FOR ENGINEERING MECHANICS

K. An¹, X.-L. Wang¹, T. M. Holden², A. D. Stoica¹, P. K. Liaw³, H. Choo³,
and C. R. Hubbard⁴

¹Neutron Scattering Science Division, Oak Ridge National Laboratory, Oak Ridge, TN

²Northern Stress Technology, Deep River, ON, Canada

³Dept. of Mat. Sci. and Eng., The University of Tennessee, Knoxville, TN

⁴Mat. Sci. and Tech. Div., Oak Ridge National Laboratory, Oak Ridge, TN

The VULCAN diffractometer at the SNS is scheduled for commissioning in 2008. This instrument is designed for materials science and engineering studies. With VULCAN users can not only conduct mapping of residual stresses, chemistry, microstructure and texture but also measure dynamically mechanical deformation response, material chemical properties change and microstructure evolution under dynamic loading (e.g. fatigue) or severe material processing (e.g. welding).

The optics design features a focusing neutron guide system, wide-angular detector coverage, and a small-angle area detector. By employing an interchangeable neutron guide-collimator system, the instrument can be optimally configured for individual experiments. In the high-resolution mode, the instrument resolution is 0.2%, with an incident beam flux of 2.5×10^7 n/cm²/s. In the high-intensity mode, the incident beam flux reaches 1.5×10^8 n/cm²/s while the resolution remains better than 0.6%. With such a high flux, the count rate in detector is estimated to reach a few thousand counts per pulse. With special sample environments, such as the vacuum furnace and unique multi-axial tension-torsion load frame, etc., VULCAN extends the neutron study into wider areas of material science and engineering mechanics.

VDRIVE, a user-friendly Data Reduction & Interactive Visualization software, is being developed for VULCAN. VDRIVE aids users to observe and interpret scientific/engineering data instantly and to assure the best use of neutrons, which is especially critical for kinetic behavior measurements. VDRIVE automatically reduces, analyzes and visualizes time-of-flight (TOF) neutron data in various interactive outputs. The real-time data analysis reduces the hassle of dealing with massive TOF data and the visualization gives users a sense of vivid projection of the scientific/engineering results

The construction of VULCAN is supported by the Canada Foundation for Innovation. In addition, the US National Science Foundation [Major Research Instrumentation (MRI) Program: DMR-0421219, with Dr. C. L. Bouldin as the Program Director] funded the sample environment suite for VULCAN, which includes load-frames, furnaces, and electro-chemical cells. The US Department of Energy, Office of Energy Efficiency and Renewable Energy, provides additional funding for completing the instrument.

Information page

This abstract is submitted for ICRS conference.

It is permitted to post the abstract on the DXC web side.

Presenting author:

Ke An Ph.D.

Spallation Neutron Source, Oak Ridge National Laboratory

865-241-1899

kean@ornl.gov

1 Bethel Valley Rd , P.O. Box 2008,MS 6460

Oak Ridge, TN 37831

It will be a poster and it will be ICRS evening poster session.

We do not intend to publish a proceeding paper because it is an instrument poster.