

**THE NEW ENGINEERING NEUTRON DIFFRACTION INSTRUMENT AT
HFIR AND ITS APPLICATION TO STUDIES OF THE BEHAVIOR OF
STRUCTURAL MATERIALS**

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The High Flux Isotope Reactor, HFIR, at Oak Ridge National Laboratory is the highest flux reactor-based source of neutrons for materials research in the United States. Thermal and cold neutrons produced by the HFIR are used for research in physics, chemistry, materials science, engineering and biology. Fifteen new instruments are being installed at HFIR; of those that are operational one is the next generation neutron residual stress mapping facility, NRSF2, for measurement of material behavior during deformation and for mapping of residual stresses throughout the thickness of components.

NRSF2 components include a Si wafer, doubly bent focusing monochromator, a large capacity sample positioning system with , two different Z-stages, incident and diffracted beam collimators, seven position sensitive detectors mounted in a detector shield, and LabView data collection and data analysis codes. Sample environment systems include a 5000 lb load frame for tensile/compression experiments, a 2-circle Huber sample orienter, several furnaces and a unique induction heater insert for use with a 5T superconducting magnet. Several studies were completed during installation and research highlights from the neutron residual stress mapping facility show nearly two orders of magnitude improvement in performance compared to our prior engineering diffractometer.

