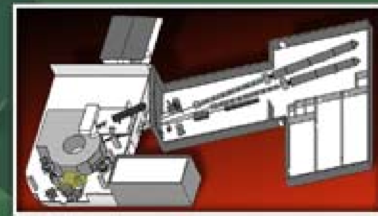


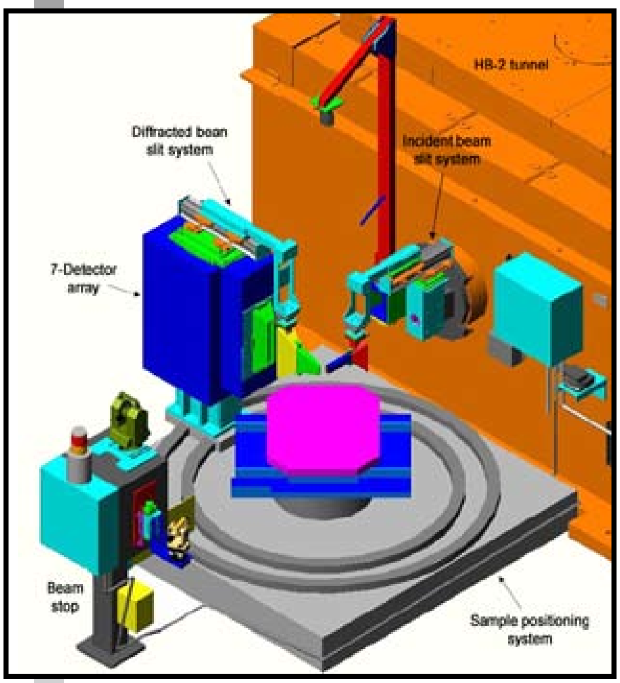
Instrument Fact Sheet

Beam Line HB-2B

High Flux Isotope Reactor

NRSF2 – Neutron Residual Stress Mapping Facility

NRSF2 at the HFIR HB-2B beam port is optimized for strain measurement and determination of residual stress in engineering materials. The large-specimen "XYZ" instrument is designed for spatial scanning of strains at depths from submillimeters to centimeters. The sample orienter can be used to determine the stress tensor and texture as a function of location. The sample orienter can also be used for mapping strain in large-grained materials and within single crystals. The high flux and large detector coverage allow real-time, in situ studies or high-resolution mapping. Ancillary equipment available for use at NRSF2 includes a 2,267-kg uniaxial (tension or compression) load frame, a Huber Eulerian cradle, high-temperature furnaces (vacuum or air), and a 5-T superconducting magnet with an induction furnace insert. Custom-built sample environment systems can be installed on the XYZ sample positioning system. A metrology system consists of a Laser ScanArm, Laser Tracker, and SScanSS virtual instrument software. These tools are used to plan experiments, establish measurement locations in the sample coordinate system, calculate beam attenuation, check for potential collisions, and generate the script file for running NRSF2. Together they reduce neutron beam time used for alignment and increase accuracy of location of measurement.



Applications

The penetrating power of neutrons is useful in mapping residual stresses in engineering materials. Examples of applications include residual stress maps of welds, heat-treated samples, forgings, extrusions, bearings and races, fasteners, and composites. Neutron diffraction studies of materials under applied stress reveal phase- and grain-level knowledge of deformation processes, which is fundamental for developing finite-element method and self-consistent field models of materials behavior. Also characterized are strains in functional materials, such as piezoelectrics under the influence of electrical fields, shape memory alloys, and hydrogen storage materials.

User Access

NRSF2 at HB-2B is sponsored by the Assistant Secretary for Energy Efficiency and Renewable Energy, Vehicle Technologies Program, as part of the High Temperature Materials Laboratory User Program (HTML), Oak Ridge National Laboratory. Information about the HTML rapid access proposal process can be obtained from html.ornl.gov.

Specifications

Beam spectrum	Thermal
Monochromator	Stacked Si wafers with vertical and horizontal focusing
Monochromator takeoff angle	88° (fixed), λ= 1.452 Å (Si 511); 1.540 Å (Si 422); 1.731 Å (Si 331); 1.886 Å (Si 400); 2.275 Å (Si 311); 2.667 Å (Si 220)
Flux on sample	3 x 10^7 n/cm^2/s (Si 331 and Si 400)
Detector angle range	70–110° optimal
Detection system	7 linear position-sensitive detectors
Position-sensitive detector coverage	5° 2Θ ±17° out of plane
Sample positioner Z elevator Z translation	Ω ± 180° X ± 200 mm Y ± 100 mm Z ± 100 mm, 500 Kg Z ± 200 mm, 50 Kg
Nominal gage volume	Width: 0.3–5 mm; Height: 0.3–20 mm
Peak location precision	0.003° 2Θ
Sample environments	• Load frame for tension and compression (2,267-kg) • Huber Eulerian cradle for tensor and texture • Vacuum and environmental furnaces • 5-T superconducting magnet with induction heater

Status: Operational

For more information, contact

Instrument Scientist: Camden Hubbard, hubbardcr@ornl.gov, 865.574.4472

http://neutrons.ornl.gov/hfir_instrument_systems/HB-2B.shtml

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