VULCAN

Engineering Materials Diffractometer

Spallation Neutron Source

BEAMLINE

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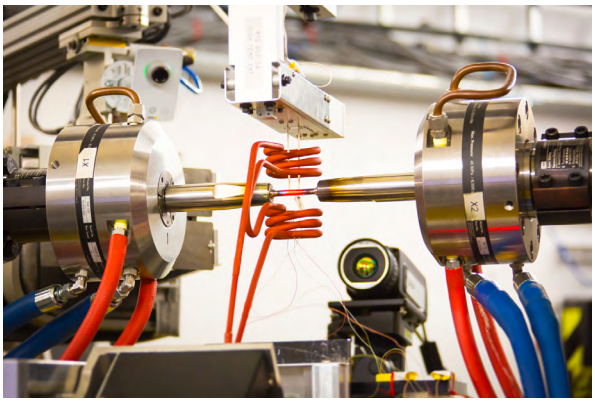
VULCAN is designed to tackle a variety of problems in materials science and engineering, including deformation, phase transformation, residual stress, texture, and microstructure studies. VULCAN provides rapid volumetric mapping with a sampling volume of 1 mm^3 and a measurement time of minutes for common engineering materials. In extreme cases, VULCAN has the ability to study kinetic behaviors in sub-second times. Through these measurements, VULCAN can help scientists and engineers predict the reliability of structural components and better understand how materials behave under extreme conditions. The instrument is capable of hosting large sample environments up to 2 ton of weight. Available sample environments and equipment include a unique load frame capable of multi-axial loading and fatigue tests with an induction heater that heats to 1273 K, a high-temperature vacuum furnace that heats to 1873 K, a controlled atmosphere furnace that heats to 1773 K, a battery cycler, a high-voltage ac/dc field, and standard equipment from the sample environment group. Non-standard operando devices can be accommodated as need basis.



APPLICATIONS

Research areas that VULCAN can benefit include but are not limited to the following:

- In situ studies of materials behavior during processing: phase formation, temperature distribution, texture changes, stress development, precipitation.
- In situ loading studies of structural or functional materials at high temperatures: phase transformation, fatigue damage, deformation in nanostructured materials, creep behaviors, piezoelectric and shape-memory alloys.
- Phase transformation/transition kinetics during material synthesis.
- Energy storage/conversation materials under electrochemical cycling.
- Residual stress and microstructure changes in engineering components.

SPECIFICATIONS

Sample-to-detector distance	+/-90º banks ~2.3 m 150º bank ~2 m
Scattering angles	+/-90º banks V: ±12.25º H: +/-11º from center 150º bank V: +/- 10.9º H: +/- 5.5º from center
Wavelength bandwidth/ d-spacing band (Å)	~1.44 at 60 Hz d: 0.5-1.5 ~2.88 at 30 Hz d: 0.5-2.5 ~4.32 at 20 Hz d: 0.5-3.6
Resolution (high-angle one in parentheses)	~0.24% (0.1%) in high-resolution ~0.40% (0.12%) in high-intensity ~0.53% (0.16%) in super high-flux
Flux on sample ($n/s/cm^2$) at 60 Hz	2.2×10^7 in high-resolution mode 6.7×10^7 in high-intensity mode
Beam size	Incident slit: 0.2–12 mm in horizontal direction, 0.2–12 mm in vertical direction
Beam divergence	Horizontal: 0.2° under HR 0.6° under HI, vertical: 1.6°
Receiving collimators	2 or 5 mm

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