Flight Path 2

SMARTS Fact Sheet

Spectrometer for Materials Research at Temperature and Stress

FOR MORE INFORMATION, CONTACT:

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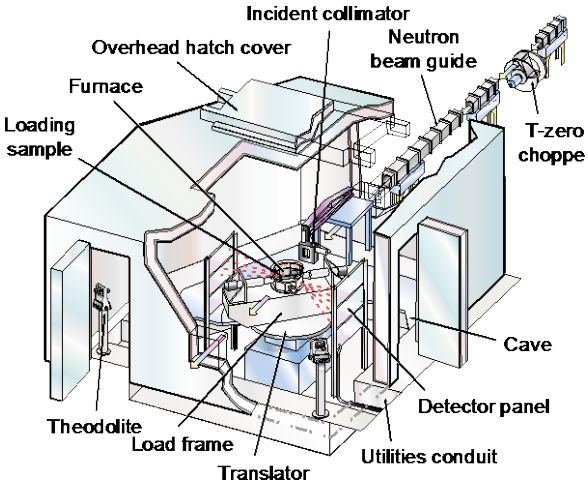
The SMARTS is a third-generation neutron diffractometer optimized for the study of engineering materials. It was funded by DOE and constructed at the Lujan Center, coming on line in the summer of 2001. SMARTS provides an exciting range of capabilities for studying polycrystalline materials focusing on two areas: the measurement of deformation under stress and extreme temperature, and the measurement of spatially-resolved strain fields. The underpinning technique is neutron diffraction, which has been used to study engineering structural materials since the early 1980s.

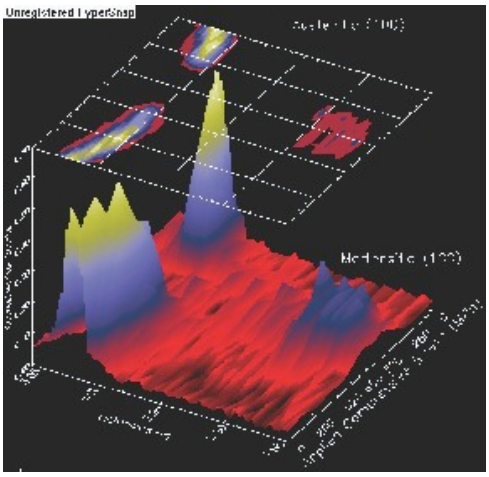
SMARTS expands the application base of neutron diffraction to a wider range of engineering problems than previously possible. With an extensive array of in situ capabilities for sample environments, it enables measurements on small (1 mm^3) or large (1 m^3) samples. Components with dimensions up to 1 m and up to 1500 kg can be positioned precisely in the beam. Permanently mounted alignment theodolites provide a simple and efficient way to position samples or equipment to within 0.01 mm.

The furnace and load frame suite allows research on materials under extreme loads (250 KN) and at extreme temperatures (1500 °C). In situ uniaxial loading on samples up to 1 cm in diameter at stresses of 2 GPa and with lower stresses at temperatures up to 1500 °C are routine.



"Short" radial collimator supported between load frame and detector.

Specifications	
Performance	
Moderator	Chilled H_2O, high resolution
Resolution at 90° (wavelength dependent)	~ 0.4%
d-spacing range	~ 0.5 - 4 Å
Nominal time for 1 cm^3 under load at temperature	~ 10 minutes
Nominal time for 1 mm^3 in 10-mm-thick Fe plate	~ 60 minutes
Primary Flight Path	
Moderator to sample	~ 31.0 m
Incident collimation (at sample)	1 - 625 mm^2
Secondary Flight Path	
Sample to 90° tube	~ 1.5 m
2Θ angle subtended (each 90° bank)	~ 30°
Load-Frame Furnace	
Maximum uniaxial force (compression or tension)	250 KN
Actuator motion	0.15 m
Furnace maximum temperature—under load	1500°C
Furnace maximum temperature—stand alone	1800°C
Minimum temperature	200 K
Specimen geometries	Threaded tesile/cylinder compression
Magnet	1.5 T
Translator	
Capacity	1500 kg
Motions	X = 0.3 m, Y = 0.3 m, Z = 0.6 m, R = 370°
Radial Collimators	
2Θ angled subtended	20°
Spatial resolution parallel to beam	0.5,1, 2, 3, 4 mm



Development of diffraction pattern during stress-induced phase transformation in super-elastic nickel titanium.

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