FIE-TAX

Fixed-Incident-Energy Triple-Axis Spectrometer

High Flux Isotope Reactor

BEAMLINE

HB-1A

The Fixed-Incident-Energy (14.5 meV) Triple-Axis Spectrometer uses a double-bounce pyrolytic graphite (PG) monochromator system. The first monochromator (M1) is flat and the second monochromator (M2) is vertically focused. Two PG filters, one after each monochromator, are used to reduce λ/2 contamination. These filters, together with the double monochromator system, provide HB-1A with an exceptionally clean beam nearly free of higher-order contamination neutrons (only 0.01%)

This instrument has one of the most intense monochromatic neutron beams at the HFIR, as well as a very low background. Typical energy resolution is 1 meV (full-width half maximum at the elastic line), but this value can be reduced to 0.5 meV with the Be analyzer. Due to the combination of high flux, low background, and very low higher-order contamination of the beam, HB-1A is ideally suited for investigations of single crystals (mm-sized or larger), powders, and thin films with weak scattering signals. HB-1A is also an exceptional instrument for diffraction studies requiring variable temperatures (T), magnetic fields (H), high pressures (P), and electric fields (E).

APPLICATIONS

HB-1A is a valuable tool for researchers in condensed matter physics, materials science, and chemistry for crystallography and solid state magnetism measurements in novel materials. Typical applications include:

- Parametric neutron diffraction studies (T, H, P, E) of structural and magnetic phase transitions
- Phase diagram investigations under various extreme conditions
- Magnetic structure determination, especially for materials with small, ordered moments
- Exploration of quantum criticality and magnetic correlations

SPECIFICATIONS

Beam spectrum	Thermal
Monochromator	PG(002) crystals
Monochromator takeoff angle	$2\Theta_M = 41.3°$ $E_i = 14.5$ meV
Analyzers	PG(002), Be(002), Be(101), Si(111)
Sample angle	±160°
Scattering angle	-5 to 130°
Analyzer angles	-60 to 120°
Detector	Single ^{3}He gas counter
Collimations	Premonochromator: 40′ Monochromator-sample: 10′, 20′, 40′ Sample-analyzer: 10′, 20′, 40′, 60′, 80′ Analyzer-detector: 20′, 60′, 80′, 240′
Filters	Sapphire pre-monochromator 2 PG; after M1 and M2
Flux at sample	~ 4.2×10^7 n/cm^2-s
Momentum range	0.2 to 4.8 Å^{-1} (elastic configuration)

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