McMaster Nuclear Reactor Beam Port #6

MAD

McMaster All-Purpose Diffractometer

SPECIFICATIONS

Monochromator	Hot-pressed Silicon
$2\Theta_M$	41.3°
Wavelength	λ = 2.21 Å (111)
Beam Size at Sample	50 mm x 50 mm with adjustable vertical and horizontal slits
Flux at Sample	~1x10^6 n/cm^2/sec
Collimations	Monochromator-Sample: 50' Soller collimator Sample-Detector: Oscillating radial collimator
Detector	1.5 m curved linear position-sensitive BF_3 detector. Continuous 80° coverage with 800 wires at 0.1° spacing
Scattering Angles	5° < 2Θ < 85° at 0.1°

The McMaster All-purpose Diffractometer (MAD), located at Beam Port 6 of the McMaster Nuclear Reactor (MNR), is a versatile neutron diffractometer designed for both single-crystal and powder diffraction. It uses a monochromatic neutron beam with a wavelength of 2.21 Å, selected by the (111) reflection of a silicon monochromator, with minor (~1%) λ/2 (from multiple scattering) and λ/3 contamination. The nominal beam size is 50 mm x 50 mm at the sample position and can be adjusted using two sets of sample slits to accommodate different sample dimensions.

A recent upgrade from a point detector to a position-sensitive linear detector (originally of the C2 powder diffractometer at the NRU reactor) has significantly improved counting efficiency, enabling high-throughput measurements, such as powder diffraction across multiple samples or under varying external parameters (e.g., temperature). In addition, the combination of the linear detector with a three-axis goniometer allows users to access a large volume of reciprocal space for single-crystal studies.

Current sample environments include an ARS cryofurnace, offering stable temperature control from 7 K to 700 K, and a humidity chamber with moderate temperature control. However, when sample environments are installed, rotational freedom is limited to approximately 5° within the scattering plane. MAD is also in the process of acquiring a ^{4}He cryostat with a ^{3}He insert for low-temperature measurements in the 300 mK to 300 K range.

Available Sample Environments

- ARS DE202-cryocooler with 800K interface
- Humidity Chamber for substrate-mounted films (4-80 °C)

Instrument Contacts

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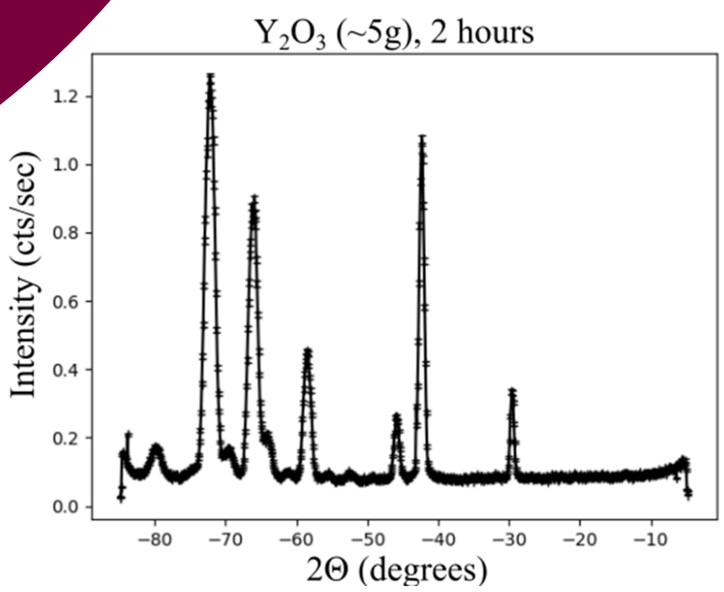
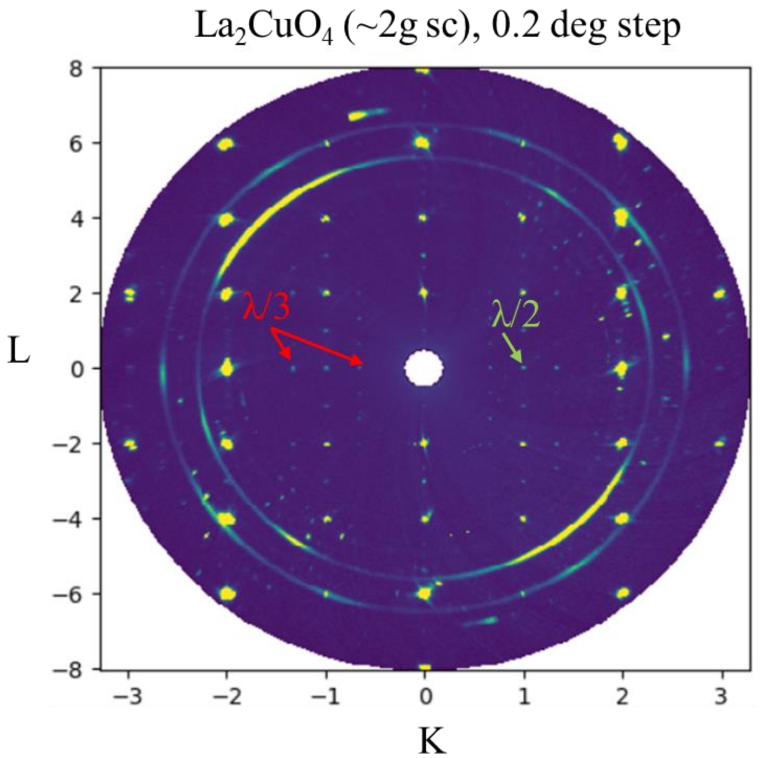
Powder Diffraction of Y_2O_3





Reciprocal Space Mapping of La_2CuO_4 Single Crystal

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