POWGEN

Powder Diffractometer

Spallation Neutron Source

BEAMLINE

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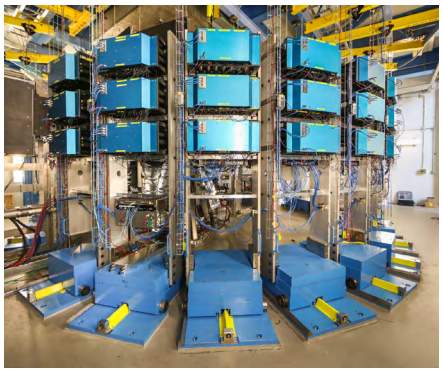
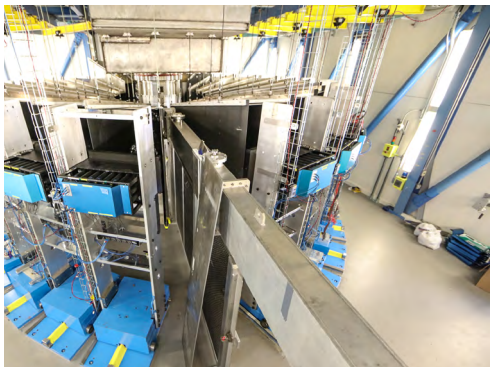
POWGEN is a general-purpose powder diffractometer useful for a wide range of structural studies. It can cover d-spacings from ~0.1 Å to 8 Å in a single measurement ideal for both traditional Rietveld data and PDF measurements, albeit for a longer collection time. Rietveld measurements for traditional size samples (0.3–3cc) can be completed in 1–2 hours or less, with a <0.1% resolution at short d-spacings and <2.5% resolution for nearly all d-spacings of interest. Alternatively, much of this resolution can be traded for intensity, making it possible to take shorter measurements while still maintaining good resolution. It is also possible to collect data from much smaller samples with a longer collection time. The adjustable bandwidth-limiting choppers allow for large variations in the incident wavelengths and pulse repetition rate. Interchangeable guide sections and the ability to trade resolution for intensity at the analysis stage allow users great latitude to optimize the data range, resolution, and statistical precision for each experiment.





APPLICATIONS

Scientific studies using this instrument encompass a wide range of novel materials. These include, but are not limited to, structural studies of energy storage materials such as battery materials, ceramic membranes for solid oxide fuel cells and oxygen sensors, hydrogen storage materials, high-entropy alloys and thermoelectric materials. Fast data collection allows processes to be observed in situ, while the availability of long d-spacing also enables the study of magnetic materials such as magnetic semimetals, multiferroics, Tc superconductors, magnetocaloric materials and molecular magnets. The availability of magnetic field capability allows the study of field-induced structural and/or magnetic transitions. POWGEN capabilities can contribute to understanding materials such as zeolite and aluminophosphate frameworks; metal-organic frameworks; ferroelectrics; and ab initio structure solutions of complex polycrystalline materials.

SPECIFICATIONS

Moderator	Decoupled poisoned super-critical H_2
Source-to-sample	60 m
Sample-to-detector	2.5–4.7 m
Flight path	44 m straight guide followed by 6 m inter-changeable high-intensity or high-resolution sections
Detector angular coverage	$10° < 2\theta < 170°$
Detector coverage	1.2 steradians (12 m^2)
Bandwidth	1Å (tunable incident wavelength from 0.533 – 4.797 Å)
Resolution	$0.0008 < \Delta d/d < 0.025$
d-spacing range (optimal)	60 Hz: 0.1–8 Å (in single measurement), up to 38 Å with multiple measurements
Sample Environment	24 Sample changer:10–300 K Orange cryostat: 2–300 K Cryofurnace: 5–500 K or 30–700 K Vacuum furnace: 1200° C Gas-flow furnace: 850° C Magnet: 0–5 T, 2–300 K

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