Contribution ID: **39** Type: **not specified**

Neutron Imaging - Material research in real space

Thursday, 22 May 2014 20:30 (1 hour)

Neutron imaging is a method that directly provides real-space information about the sample composition using neutrons as probing beam. In the standard configuration the resulting images represent the neutron shadow cast by the, for neutrons, semi-transparent sample. The basic principle is very similar to the more known X-ray radiography. The difference lies in the neutron matter interaction that provides a very different set of attenuation coefficients for the elements than the ones provided by X-rays. Radiography is the basic mode for neutron imaging, but the method is not limited to the acquisition of two-dimensional images. Computed tomography using neutron projection data makes it possible to reconstruct the three-dimensional distribution of attenuation coefficients in the sample. Depending on the installed instrumentation it is possible to reach voxel sizes of 13.5um for small samples, while it is possible to support samples with dimensions up to 250mm at lower resolution. For dynamic samples it is also possible to make real-time sequences. The acquisition rate is sufficient for many experiments with water in porous media. Most neutron imaging experiments are performed using radiography and tomography, but the use of optional energy selection devices in the beam makes it possible to perform Bragg edge imaging by acquiring images at different neutron energies. Neutron grating interferometry imaging is also a method that can provide additional information about the sample. The interferometer provides two additional images containing the differential phase shift and the dark field. The dark field images have proven useful in investigations of magnetic domains since it is sensitive to the small neutron scattering angles caused by the magnetic domain walls.

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Session Classification: Evening Sessions