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New design for D16 at the ILL

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D16 is one of ILL's cold neutron diffractometer. It is a 2-axis small-momentum transfer diffractometer with variable vertical focussing, for the study of partially ordered structures such as stacked membranes or clays. The scattering geometry obtained with large, vertically oriented samples, profits the most from the large vertical cross section of the beam at the sample position. A high-resolution SANS setup is used routinely in experiments requiring the 1% wavelength band width and the high angular resolution of the instrument. Because of its special characteristics, D16 remains unequaled for the study of a wide range of systems in biology, physics and material science. In the last decade D16 has undergone several major upgrades: in 1999 with a completely new design, in 2007, in the frame of the ILL millennium program the instrument has been re-sitted and the design revisited. In 2008 D16 will have a new high resolution, high count rate detector (MILAND). The poster will present the new design, the major characteristics and performances of the instrument, as well as recent examples of experiments performed on D16.

Keywords: neutron diffraction, SANS, instrumentation

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CG2 general-purpose high-flux SANS instrument at HFIR at Oak Ridge National Laboratory

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Within the past year, the High Flux Isotope Reactor (HFIR) has resumed routine operation and service to the scientific user community with a number of significant upgrades. Among the most important of these is a new supercritical hydrogen moderator (T ~ 20 K) that is the brightest cold source currently available. While this will eventually provide neutrons to a whole suite of scattering instruments through four cold neutron guides, the two flagship instruments, new small-angle neutron scattering (SANS) instruments on CG2 and CG3 have been installed and commissioned. The CG2 SANS (General Purpose SANS, also known as SANS1, funded by the Department of Energy (DOE) Office of Basic Energy Sciences) is a 40m maximum total flight path pinhole SANS instrument variable wavelength and a large area (1m^2 squared) high count-rate, (more than 100 counts/pixel/s) high-resolution (5mm^2 pixels) detector that can translate from 0 to 45 cm off-axis to increase the dynamic Q-range (~0.001-1 A^{-1} overall). With a measured flux on sample of 10^7/sec/cm^2 and beyond in high-throughput configurations, this instrument is comparable to the best worldwide. This dramatically improves both the quantity and quality of data that we can collect from samples from a variety of systems, enabling us to better serve the neutron scattering community. At the time of this abstract the instrument has successfully operated for 7 reactor cycles, including 3 in which it was fully available to users through an open, peer-reviewed proposal system.

Keywords: instrumentation, SANS, neutron scattering techniques

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Neutron transmission strain tomography

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In many respects, strain mapping by neutron and synchrotron X-ray diffraction can be regarded as imaging techniques in 2D or 3D, i.e. the spatially resolved determination of a material property within the interior of an object. However, whereas in the conventional sense 3D imaging is normally concerned with the spatial variation of attenuation coefficient, in the case of strain mapping it is the spatial variation of elastic strain which is being imaged. The aim of the study here is to present the concept of strain tomography using Bragg edge neutron transmission measurements. The principle of this novel approach is to analyze residual strain fields by de-convolution of unknown distributions of residual elastic strains from redundant sets of data collected from gauge volumes representing sections through the region of interest. The setup of Bragg edge neutron transmission measurement is such that the gauge volume represents the complete trace of the incident beam through the sample. As a result, each individual measurement can be thought to represent an average strain within the sampling volume. Thus, the strain variation within the gauge volume may be significant. On the other hand, a data set collected over a range of positions and rotations allow the possibility of reconstructing the entire strain distribution within the interior of an object. This study illustrates the application of the principle using neutron transmission Bragg edge measurements on a well characterized VAMAS round robin shrink fitted Al ring and plug sample. The large strain discontinuity present within the sample was successfully resolved and the prediction of hoop and radial strain showed very good agreement with the known strain field within the sample.

Keywords: neutron transmission, Bragg edge, residual stress

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BioRef - a time-of-flight reflectometer at Hahn-Meitner Institute Berlin

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