19-21 (2007).

Keywords: multiferroics, neutron diffraction, high resolution

P01.08.55

Acta Cryst. (2008). A**64**, C188

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

P01.08.56

Acta Cryst. (2008). A**64**, C188

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

P01.08.57

Acta Cryst. (2008). A**64**, C188

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

P01.08.58

Acta Cryst. (2008). A**64**, C188-189

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

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BioRef will be a time-of-flight reflectometer complementing the monochromator based V6 reflectometer at Hahn-Meitner Institute. Combined with an in-situ infrared spectrometer it will be optimised for soft matter applications at solid-liquid interfaces. A flexible double-chopper set-up together with a wavelength band chopper will enable the selection of well defined wavelength bands at different wavelength resolutions in order to optimize measurements with regard to the given application. The selection of different distances between the first choppers allow for choosing constant resolutions of $\delta\lambda/\lambda$ between 1% and 5% , while different frequencies of the choppers are intended to alter the used bandwidth. A width of the band of 4 Å up to 12 Å can be selected between a minimum wavelength of app. 3 Å and a maximum of 15 Å. Lower wavelength resolutions than 5% can be realised when giving up the constant resolution. A state-of-the-art 2D position sensitive ^{3}He detector will be used for the reflectivity measurements in horizontal scattering geometry. The time-of-flight mode is also chosen to realise the investigation of dynamic interface processes under shear and flow conditions. A q-range spanning 3 orders of magnitude and reflectivity measurements over 7 orders of magnitude are envisaged and their feasibility is supported by Monte Carlo simulations.

Keywords: neutron time-of-flight, neutron reflectivity, infrared spectroscopy

P01.08.59

Acta Cryst. (2008). A**64**, C189

The new polarised hot neutron single crystal diffractometer POLI-HEiDi at FRM II

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Polarised neutron diffraction is one of the most important tools to determine magnetic structures. One-dimensional neutron polarisation analysis is used to determine the directions of magnetic moments. In addition, the recently developed spherical neutron polarimetry (SNP) is very useful to investigate complex magnetic structures in detail. For instance, the non-diagonal terms of polarisation matrices measured in SNP give us important informations on chiralities and magnetic domains of magnetic structures. The new polarised neutron diffractometer POLI-HEiDi- currently under construction at the hot neutron source (SR 9) at FRM II -is dedicated to investigate complex magnetic structures by means of SNP. Two zero-field polarimeters, the Cryopad and the MuPAD, are available for this task and could be used with the new instrument. 3He spin filters will be used for producing and analysing the neutron polarisation. New important parts and components for the polarised neutron diffractometer POLI-HEiDi were build and tested recently. In this report we will present these new components as well as the concept and design of the whole instrument. For 2008 the commissioning of the most important components like the detector-analyser unit Decpol, the zero-field sample environment Cryopad as well as the controlling electronics software is planned. Our project is carried out by the Institut fuer Kristallogaphie, RWTH Aachen University with financial support of the German Ministry of Education and Science (BMBF).

Keywords: neutron instrumentation, polarized neutron scattering, neutron spin filtering

P01.09.60

Acta Cryst. (2008). A**64**, C189

Polarimetric neutron spin echo spectroscopy

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Neutron Spin Echo spectroscopy (NSE) uses polarized neutrons and in turn polarization analysis is an intrinsic feature of NSE. However, the multifaceted dynamics of antiferromagnets and hellimagnets ask for more than the classical Neutron Spin Echo set-up (NSE). In these systems the magnetic interaction vector is complex and the neutron beam polarization is not necessarily flipped upon scattering but can rotate at any angle around or towards a specific direction. The only way to access the components of the scattered polarization that are transverse to the incoming polarization is to implement a zero-field area around the sample position. Here we present the feasibility test and first results of the Polarimetric NSE, a powerful technique which combines a variant of the Intensity Modulated NSE (IMNSE) and the Cryopad. The Cryopad is a zero-field polarimeter based on Meissner shields and mu-metal screens able to do the most generalized polarization analysis experiments measuring all theoretically possible pair-correlation functions at any point of the reciprocal space. On the other side, IMNSE is a powerful variant of NSE that disconnects completely the sample area from the precession area at the price of some intensity losses due to the addition of polarizer and analyzer devices. This new technique was successfully developed on the wide angle NSE spectrometer SPAN at the HMI and then implemented on IN15 at the ILL, where new results on the magnetic relaxation in MnSi, a reference hellimagnet were obtained.

Keywords: neutron spin echo, neutron polarization analysis, chirality

P01.08.61

Acta Cryst. (2008). A**64**, C189−190

The study of thermal diffuse scattering measured by pulsed neutron diffraction

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In this presentation, we will report the experimental results of the thermal diffuse scattering (TDS) around strong Bragg peaks in some analyzer crystals measured by pulsed neutron diffraction technique at near back scattering conditions and discuss the comparison of those experimental results with theoretical predictions. We measured the thermal diffuse scatterings around some analyzer crystals Bragg peaks; pyrolitic graphite PG(002),