PS01.09.11 PROGRESS IN SMALL-ANGLE NEUTRON SCATTERING AT THE INSTITUT LAUE LANGEVIN
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The new high-performance small-angle scattering facility D22 of the ILL went in operation in April 1995. After a shutdown for improving its detector performance, normal user operation was planned again from spring 1996 on.

Small-Angle Neutron Scattering (SANS) is a well-established technique at the ILL. The instrument D11 has been a world-wide reference for all other facilities of its kind since its commissioning in 1972. During the recent long shutdown of the ILL for a reactor repair, D11 was modernized and improved. The high demand for beam time, and the advent of new sample environment techniques (real-time and shear experiments etc.) motivated the plans for building a new facility, D22. ILL's second SANS instrument, D17, is being turned into a dedicated reflectometer.

D22 takes advantage of the high brilliance of the guide H512 (cross section 40 x 55 mm) pointing at the horizontal cold source. The 96 x 96 cm multidetector moves along a vacuum tube of 2.54 m diameter and 20 m length and can be laterally moved and rotated around its vertical axis. One detector setting can provide a qmax/qmin ratio of up to 50. A 25 cm long velocity selector by Dornier of 94 % peak transmission, rotating at a maximal speed of 28300 rpm, produces wavelength bands between 3 and 40 Å with a spread of 8 to 20% (FWHM) of an unequalled flux at the sample (maximum > 1 x 10^8 cm^{-2} s^{-1}).

The improved features of D11 and D22 have allowed us to perform new types of experiments, amongst them neutron interferometry, and to push the limits of feasibility further, thus opening the door for studying new systems.

PS01.09.12 ADVANCED NEUTRON DIFFRACTION FOR MICROSTRUCTURE ANALYSIS OF POLYCRYSTALLINE MATERIALS.
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Recently, we have developed novel high-resolution modifications of conventional neutron diffraction techniques - Bragg diffraction peak analysis (BDPA) and Energy Dispersive Transmission Analysis (EDTA) - for the strain and microstructure distortions of polycrystalline materials. Using Bragg diffraction optics (focusing in real and momentum space) the new modifications provide good diffractometer luminosity and $\Delta d/d$ resolution of about 10^{-3} of the diffraction profile of an etalon sample. The resolution is represented by the FWHM and in the latter case of EDTA it is related to the Gaussian of the corresponding cumulative function. [1-3]. Besides the measurements of macrostrains with an extremely high sensitivity up to 10^{-5} the novel modifications provide also unique possibilities for microstrain, grain size and dislocation density studies of plastically deformed polycrystalline materials on the basis of the diffraction profile analysis. In contrast to X-ray profile analysis, the experiments with neutrons are not restricted to the surface, but can be performed on rather large bulk samples and at much higher scattering angles where the X-ray intensities strongly decrease. These modifications have been implemented on diffractometers in NPI and PTB where effects of both elastic and plastic deformations are commonly investigated, and which can be used by external users. Thanks to the exploitation of focusing effects and special diffraction geometries in combination with position sensitive detectors for data acquisition, reasonable counting times even at our medium power reactors are achieved. Results of investigations obtained with different plastically deformed polycrystalline samples of Fe(110) and Fe(321) will be presented.

[1] P.Mikula et al., Journal de Physique IV, Coll.C7, 3 (1993) 2183.
[2] M.Vrana et al., Nucl. Instrum. Methods, A338 (1994) 125.
[3] P.Mikula et al., Physica B, 213&214 (1995) 845.

PS01.09.13 DESIGN AND PERFORMANCE OF THE NEW TIME-OF-FLIGHT SMALL ANGLE NEUTRON DIFFRACTOMETER *SAND* AT IPNS.
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A time-of-flight small angle neutron diffractometer SAND, which is capable of providing data in a wide q region of 0.0035 to 0.8 $Å^{-1}$ in a single measurement, has been commissioned at IPNS. This instrument has been built upon the more than 10 years experience with the proto-type time-of-flight SANS instrument SAD which has been serving the scientific user community during the past decade at IPNS. SAND has a fixed geometry but simultaneously uses neutrons with a wavelength region of 0.8 to 14 Å, thus producing data in such a large dynamic range in q. Some of the new features in the new instrument when compared to SAD are: a larger area detector, larger sample-to-detector distance, a frame elimination chopper to extend the wavelength range upto 28 Å, two sets of soller collimators and beam stops and a larger sample area. To widen the dynamic range in q even further as well as to improve the statistics in the high q data, an array of linear position sensitive detectors is being added. The design and perfomance of SAND along with the scientific opportunities provided by this instrument will be discussed.

Work supported by U.S. Department of Energy, BES, contract No. W-31-109-ENG-38. We also acknowledge the support received through a grant from National Science Foundation to Professor S.-H. Chen, MIT and another grant from Texaco Corporation.

PS01.09.14 USING BRAGG OPTICS FOR HIGH RESOLUTION NEUTRON POWDER DIFFRACTION.
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The performances of three set-ups for high-resolution powder diffraction, which are based on Bragg diffraction optics with bent perfect Si or Ge crystals, are discussed. By focusing in real and momentum space considerably higher luminosity and resolution are obtained than in conventional diffractometers using plane crystals and Soller collimators. Under optimum conditions, a FWHM of the individual powder lines of about $3x10^{-3}$ rad on 2θ-scale (or even less) can be achieved - though in a limited range of scattering vector Q around 30 nm^{-1}. Substantial advantages of the presented two and three (with an analyzer) axes arrangements arise in the case of small sample dimensions (less than 5 mm diameter) [1], high density of powder reflections in the investigated Q-range or in the case of a peak profile analysis [2]. The useful range ΔQ is mainly determined by the choice of both the lattice planes and the curvatures of the monochromator and analyzer. It can be adapted to the experimental requirements by using different reflections and the easy control of the bending radii of the crystals.

Each of the three focusing configurations can be implemented in conventional diffractometers, those in combination with a 1D position-sensitive detector being be most promising. Further improvements in the resolution and luminosity are possible by using thinner bent crystals (better resolution), sandwich-type monochromator (higher luminosity), and/or doubly-bent designs for simultaneous vertical and horizontal focusing [3].

[1] N.Niimura et al., Physica B, **213&214** (1995) 786.
[2] P.Klimanek et al., J.de Physique, Coll. C7, **3** (1993) 2143.
[3] V.Wagner et al., Nucl. Instr. & Meth. in Phys. Res., **A338** (1993) 53.