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Keywords: automation, crystallization, imaging

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Possibilities and limitations of X-ray diffraction using high energy X-rays on a laboratory system

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Recent interest in nanomaterials has increased the need to analyze structures on a local (nano) scale. However, the atomic structures of nanoparticles and nanostructured materials are not accessible by conventional methods used to study crystalline materials, because of the short ordering range in these materials. One of the most promising techniques to study nanostructures using X-ray diffraction is total scattering pair distribution function (PDF) analysis. This technique is successfully applied in a number of application areas in materials science and technology. The PDF analysis technique makes use of high quality, high energy X-ray scattering data, usually obtained at synchrotron facilities, available in several national and international research centers around the world. Despite the advantages and data quality that measurements at synchrotron beam lines offer to the researcher, in practice it can be difficult and time-consuming to get access to the facilities required. In order to be prepared as good as possible and to make optimal use of the valuable experiment time offered, it is highly desirable to perform selective measurements on candidate samples in the own research laboratory. New developments in XRD technology have been directed towards the possibility of performing nanocrystallography experiments on a standard laboratory X-ray diffraction system. In this presentation we will report on the possibilities and limitations of the use of high-energy X-rays on a homelab system.

Keywords: nanocrystalline materials, pair distribution function, X-ray diffraction

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Super high resolution powder diffractometer at J-PARC

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Neutron Science Division of High Energy Accelerator Research Organization (KEK) is constructing a Super High Resolution Powder Diffractometer (SuperHRPD) at Materials and Life Science Experimental Facility (MLF) of Japan Proton Accelerator Research Complex (J-PARC). SuperHRPD is designed to have the world best resolution $\delta d/d$ = 0.03%, which changes quite slowly in its covered *d*-range. SuperHRPD is located at about 100 m from a thin side of a decoupled poisoned moderator, which has been developed to produce a high-resolution & good S/N data to achieve the 0.03 % resolution within 100 m flight path. It has a 32 m curved guide and 50 m straight guide section between the instrument and the moderator. To prevent frame overlap caused for a long flight path, the disk choppers were installed in two places of the beam line. The measurement in various wavelength ranges is possible by using these disk choppers, and the adjustment of the choppers are scheduled. To install the beam line of long flight path, we constructed beam line building (MLF SuperHRPD BL building) and annex experimental hall (MLF SuperHRPD building) on the east side of MLF experimental hall. As soon as these buildings were completed in the end of 2007, a guide tube, various shielding blocks, etc. were set up. The *Sirius* diffractometer chamber, which had been used in the previous neutron facility, KENS, at KEK was installed at the SuperHRPD beam line (BL08). At the end of May in 2008, the first neutron was produced successfully at a spallation neutron source in MLF, and the high resolution Bragg reflections were obtained using the *Sirius* diffractometer chamber. The obtained data will be used in designing a new diffractometer chamber for BL08, which will be installed in the summer of 2009.

Keywords: neutron instrumentation, neutron powder diffraction, time-of-flight powder diffraction

P1

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4SEASONS: A high-intensity chopper spectrometer for inelastic neutron scattering at J-PARC/MLF

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4SEASONS is one of the chopper spectrometers for the spallation neutron source in Materials and Life Science Facility (MLF), Japan Proton Accelerator Research Complex (J-PARC). It is intended to provide very high counting rate up to 300 meV neutron energy with medium resolution ($\Delta E/E_i$~6% at E=0) to efficiently collect weak inelastic signals from novel spin and lattice dynamics especially in high-T_c superconductors and related materials. To achieve this goal, the spectrometer equips advanced instrumental design such as an elliptic-shaped converging neutron guide coated with high-Q_c (m=3-4) supermirror, long-length (2.5m) ^{3}He position sensitive detectors arranged cylindrically inside the vacuum scattering chamber. Furthermore, the spectrometer is ready for multi-incident-energy measurements by the repetition rate multiplication method with a special Fermi chopper (the MAGIC chopper), and polarization analysis with ^{3}He spin filters. 4SEASONS is now under construction and will be ready to use in December 2008. In this paper, we show the design of 4SEASONS and current status of its construction. 4SEASONS is supported by Grant-in-Aid for Specially Promoted Research (No. 17001001) from MEXT of Japan.