High Pressure V
New Frontiers

MS18.05.01 NEUTRON DIFFRACTION STUDY OF MAGNETIC STRUCTURES AND PHASE TRANSITIONS AT VERY HIGH PRESSURES I. N. Goncharenko, Russian Research Center "Kurchatov Institute", 123182 Moscow, Russia Leon Brillouin Laboratory, CEA-CNRS, CEN Saclay, 91191 Gif-sur-Yvette, France

High-intensity low-background neutron diffraction and high-pressure anvil technique have been used in the studies of magnetic ordering up to the pressures of 10 GPa (sapphire anvils) and 25 GPa (diamond anvils) [1]. The experiments have been performed both for powders and single crystals in the wide temperature range 1.5-300 K.

With the above technique, various magnetic materials have been studied, including hydrides, pnictides and chalcogenides of transition metals, lanthanides and actinides. A special interest was devoted to cases, where a high sensitivity of magnetic properties to the interatomic distances makes high pressure experiments as a powerful tool for studies of the magnetic interactions. Such a situation has been observed in uranium monopnictides, where a mixing of electronic states leads to a complicated magnetic pressure - temperature phase diagram. General traits for a transformation of a magnetic structure due to the pressure induced crystal structure transition NaCl-CsCl have been studied in europium monochalcogenides.

Future prospects of magnetic neutron studies are represented, including a combination of high magnetic fields and high pressures in neutron experiments, development of a specialized neutron diffractometer for high pressure studies.

[1] I. N. Goncharenko, J. - M.Mignot, G. Andre, O. A. Lavrova, I. Mirebeau, V. A. Somenkov, High Pressure Research, 14(1995), 41-53.

MS18.05.02 SYNCHROTRON-EXCITED RESONANT MOSSBAUER STUDY OF MAGNETIC PROPERTIES UNDER PRESSURE UP TO 80GPa. Saburo Nasu, Department of Material Physics, Faculty of Engineering Science, Osaka University, Toyonaka, Osaka 560, Japan

Using a diamond anvil cell, 57Fe Mossbauer spectroscopy under pressure up to 80GPa has been performed with the nuclear forward scattering of synchrotron radiation. A pressure-induced hyperfine interaction at 57Fe in $SrFeO_3$ has been detected at 44GPa and 300K for a first time by a quantum-beat modulation of the decay rate after collective nuclear excitation by the synchrotron pulse. Linearly polarized synchrotron pulse can easily make to clarify the direction of the hyperfine magnetic fields at nucleus. Nuclear forward scattering experiments of $SrFeO_3$ at 74GPa under external magnetic field suggest the existence of the pressure-induced magnetic phase transition from antiferro- to ferromagnetic in $SrFeO_3$.

MS18.05.03 COMPTON SCATTERING STUDY OF ELECTRONIC STATE IN METALS UNDER HIGH PRESSURE. G. Oomi[1], T. Kagayama[1], F. Itoh[2], H. Sakurai[2], H. Kawata[3] and O. Shimomura[3]. [1]Department of Physics, Faculty of General Education, Kumamoto University Kumamoto 860, JAPAN; [2]Department of Electrical Engineering, Gunma University Kiryu, Gunma 376, JAPAN; [3]Photon Factory National Laboratory for High Energy Physics, Tsukuba, Ibaraki 305, JAPAN

In the study of the electronic structure of metals and alloys (MA), it is the most essential to know the Fermi surface or the momentum distribution of conduction electrons because almost all the physical properties of MA are dominated by the behaviors of conduction electrons. The Compton scattering is well known to be a good technique to get the Fermi surface.

Pressure is also a good tool to investigate the electronic structure of MA since we can observe a lot of electronic (phase) transition by applying pressure. However there have been a few reports to study the Fermi surface under high pressure. The reason for that is mainly the technical difficulty and for Compton scattering, the lack of X(γ)-ray source intensity. Recently we can obtain the high intense X-ray by using synchrotron radiation (SR). Thus it is very interesting to apply the Compton scattering techniques to the investigation of electronic structure of MA under high pressure by using SR.

In the present work metallic Li was used as a sample because the contribution from core electron to Compton profile is small. Compton scattering measurement was carried out by using 59.34 keVX-ray (Tm-K edge) from SR.The scattered X-ray was detected by means of solid state detector. The preliminary result at ambient pressure confirmed that we can use the optical system constructed in this work for the measurement of Compton profile at high pressure.

MS18.05.04 HIGH PRESSURE STUDIES ON SEMICONDUCTOR NANOCRYSTALS: SIZE EFFECTS IN THE STRUCTURAL AND ELECTRONIC PROPERTIES OF SOLIDS. Sarah H. Tolbert(a) and A. P. Alivisatos(b) (a) Department of Chemistry, University of California, Santa Barbara, CA 93106-9510 (b) Department of Chemistry, University of California, Berkeley, CA 94720

In this talk we will explore the effects of finite size on the structural and electronic properties of solid systems. In particular, pressure induced structural transformations in CdSe, InP, and Si nanocrystals will be examined. These crystallites, ranging in size from 2 to 50 nm in diameter, exhibit phase behavior that is significantly different from the analogous bulk systems. Structural transformations are observed to be uniformly elevated in nanocrystals in comparison to bulk materials. High pressure X-ray diffraction and optical absorption are combined to understand this elevation in terms of the surface thermodynamics and kinetics of solid-solid structural transformations in nanocrystals. The results have implications for phase transition in both bulk and finite size systems. Optical properties of nanocrystals at high pressures are also examined The results are relevant for understanding the nature of quantum confinement in very small indirect gap solids.