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Abstracts
CS-10. Anomalous Hall Effect of Fe₁₆N₂ Thin Film on Ag Under Layer. M. Yang¹,², X. Zhang¹, G. Yu¹ and J. Wang¹
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Fe₁₆N₂ thin films have recently attracted a great attention because of its possession of giant saturation magnetization, large spin polarization ratio and large perpendicular magnetic anisotropy constant ¹. In this work, partially ordered Fe₁₆N₂ thin films were successfully formed by post-annealing Fe₈N thin films that were fabricated by a facing target sputtering process ². The films were prepared on (001) Ag under layer using single crystal (001) MgO substrates as shown in Fig. 1, which is different from our previous report using Fe buffer layer on GaAs substrate. The anomalous hall effect of those films was measured and investigated at different temperature. Fe₁₆N₂ thin film exhibits much higher perpendicular anisotropy at lower temperature . Its coercivity increases more sharply than Fe₈N thin film with the decrease of the temperature. The ordering of FexN cluster in Fe₁₆N₂ films may contribute to the high perpendicular anisotropy at low temperature compared with Fe₈N ².


CS-11. Spin super-exchange and magnetocoloric effects in Dy(OH)₃ nanorods. R. Zeng¹,². SETG, SCEM, University of Western Sydney, Penrith, NSW, Australia; ². ISEM, UOW, Wollongong, NSW, Australia

Systematic magnetic measurements have been performed in Dy(OH)₃ nanorods synthesized by a facile hydrothermal method. Unusual magnetic phenomena—spin super-exchange interaction has been observed in this system, which in the originate nature of anisotropy Dy³⁺ ion. The magnetocaloric evaluation indicated the super-exchange coupling have significant effect on the MCE, which derive the MCE much lower than other similar rare-earth hydroxides.

CS-12. Crystal and magnetic structure of orthosilicate Li₂FeSiO₄ by Mössbauer analysis. I. Lee¹, S. Kim¹, T. Kouh¹ and C. Kim¹
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Lithium metal orthosilicate (Li₂MSiO₄) polymorphs are becoming of next-generation electrode materials for rechargeable Li-ion battery because of their thermal stability, suitable operating voltage and capacity. Crystal structure of Li₂FeSiO₄ can be classified with three types of polymorph as β₁ (Pmm2₁), γ₁ (P2₁/n) and γ₂ (Pmnb) according to the arrangement of cation filled tetrahedral. In this study, the crystal and magnetic structure of orthosilicate Li₂FeSiO₄ has been investigated with the x-ray diffraction (XRD) and Mössbauer analysis. Vacuum-sealed solid-state method to prepare the Li₂FeSiO₄ polycrystalline powder was performed by reaction of Li₂CO₃ (99.99 %), SiO₂ (99.8 %) and FeC₂O₄.2H₂O (99.9 %) at 800 °C for 10 hours. Rietveld analysis of XRD patterns indicates that Li₂FeSiO₄ sample crystallized in γ₁-type (Space group: P2₁/n) monoclinic with the measured lattice constants of a₀=8.231, b₀=5.020, c₀=8.228 Å and β=99.24°. In order to investigate the magnetic structure in terms of Fe nucleus, temperature dependent Mössbauer spectrum recorded at various temperatures ranging from 4.2 to 295 K. The room temperature Mössbauer spectrum shows one-doublet with the measured values of ΔEₐ=2.41 mm/s and δ=0.85 mm/s indicating the Ferrous (Fe²⁺) ions occupied in FeO₄ tetrahedron. The Mössbauer spectra at 4.2 K for Li₂FeSiO₄ exhibit as asymmetrical absorption line which can be analyzed by eight Lorentzians having the experimental values of Hₕf=121 kOe, ΔEₐ=2.46 mm/s, δ=0.97 mm/s, θ=3°, φ=20° and η= 1.0. With increasing temperature, spectrum shape changes with decrease of magnetic hyperfine field (Hₕf), and then it shows double phase at 20 K which is antiferromagnetic magnetic ordering temperature (Tₙ). From these results, ferrous (Fe²⁺) ion in FeO₄ tetrahedron induced the strong electric quadrupole interaction which can be enhanced the asymmetric Mössbauer spectrum line below Tₙ.


Fig. 1 Refined XRD pattern of the Li₂FeSiO₄ at room temperature.
ABSTRACTS

Fig. 2 Mössbauer spectra of the Li2FeSiO4 at various temperatures.

CS-13. Magnetic Compton scattering study of magneto-dielectric Ba(Co0.85Mn0.15)O3−δ (BCMO) sintered samples show a ferromagnetic behavior below around 50K. The origin of their magnetic ordering was speculated to be super-exchange coupling of Co3+(d3)−O2−−Mn4+(d5) [1]. However, we have not yet succeeded in clarifying it in details. Here, it is worthwhile mentioning that magnetic Compton scattering is a unique probe for spin-polarized electron moment distribution of ferromagnetic materials, and that its cross section is proportional only to spin component of magnetization. Hence, in the present studies, the magnetic origin of BCMO in conjunction with the 1D projection of the momentum density of the spin polarized electrons of BCMO, as well as of the valence state of the 3d transition metal ion.

The SQUID measurement results show that the ferromagnetic-paramagnetic transition occurs at around 32K. The magnetization at 8 K is about 10 emu/g and the coercivity is about 1 T. The temperature dependence of the magnetic spin momentum calculated by the MCP, exhibits similar behavior as that of the magnetic moment by the SQUID measurements. This clearly indicates that the magnetic polarization of BCMO is mainly ascribed to spin momentum. We will discuss the possible magnetic origin of BCMO through the discussion of the spatial distribution of the momentum density of the

CuCr2Se4 nanocrystals have a Curie temperature above 400K, are ferromagnetic and display a large-magnopto optical effect at room temperature. Their unique magneto- dielectric and magneto- transport properties coupled with high spin polarized characteristics makes them useful in many applications. A facile solution based method involving the thermal decomposition of metal chloride precursors in selenium using oleyamine(OLA) as a solvent and stabilizing agent is used. The Cu-Cr – OLA complex prepared at 175°C and cooled to room temperature(RT) is rapidly injected into Se – OLA mixture which has been heated to 330°C. The temperature of Se – OLA at time of injection is varied from 330°C down to RT. Upon injection the reaction is heated to 330°C, 340°C, 350°C and 360°C and kept at each temperature for a holding time of 0, 60,120 and 180 minutes. Finally solution precipitated, washed, centrifuged and dried. TEM images a-c show 24.8nm average size cubic to tetrahedron shaped nanocrystals prepared when the metal precursors were injected into the Se mixture at 330°C. Images d-f show nearly monodisperse 68.1nm hexagonal crystals prepared when injection was done at RT. Different final temperatures resulted in different mean crystal sizes. XRD patterns show well defined crystalline peaks for samples provided the Cu:Cr:Se ratio was 1:2:8-10(lack of excess selenium resulted in formation of secondary phases). The mean crystallite size from XRD matched well with TEM results. M-H curves show a soft ferromagnetic behavior with higher reten- tivity and magnetic saturation as the crystal size increased. However increased temperature caused decrease in the saturation and coercivity (negligible at room temperature) for all crystal sizes. A super paramagnetic relax- ation is observed as the field cooled(FC) and zero field cooled(ZFC) curves bifurcate while lower than bulk Curie temperature is a result of surface spin canting. The electron spin resonance (ESR) data shows hybridization between localised 3d electrons of Cr3+ and delocalised holes of Se 4p band, confirming correct phase formation. Broad magnetic circular dichroism(MCD) signals with similar shapes indicate magneto-optical effects of different crystal sizes.