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X-ray Magnetic Circular Dichroism Study of Mg Doped Fe_3O_4 Thin Films

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We have performed x-ray magnetic circular dichroism (XMCD) study on a series of $Fe_{3-x}Mg_xO_4$ ($0<x<1.5$) films on MgO (001). The XMCD measurements were based on Fe $L_{2,3}$-edge x-ray absorption spectra, which is sensitive to both electronic state and local symmetry of the absorbing atom. A systematic decrease of local magnetic moments with increasing Mg concentration (x) was observed, which is in agreement with the results obtained by magnetometer measurement [1]. Our results further indicate that, in the region of $0.3<x<1.2$, the decrease of magnetic moment occurs preferentially at the d^6O_h site. The decrease of magnetic moment becomes almost even in three Fe sites at higher Mg concentrations. The correlation between the cation distribution, the structural evolution and the magnetic behavior will be discussed.

REFERENCES

[1] D.S. Lee, J.S. Wang, Dilip K. Modak, Y.S. Liu, C.L. Chang and G. Chern, J. Appl. Phys, in press (2007).

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Optical Properties of Na_xCoO_2 Thin Films and Single Crystal

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Two single-crystalline Na_xCoO_2 thin films ($x = 0.68$ and 0.75, both thickness around 3000 Å) were grown on sapphire substrate using the pulsed-laser deposition technique. One Na_xCoO_2 ($x = 0.84$) single crystal was grown by the floating-zone method. For all fresh samples, two Raman peaks, A_{1g} at 572 cm^{-1} and E_{2g} at 461cm^{-1}, are commonly observed at room temperature. However, two other different Raman features can be identified with different spots on the samples. Such behavior is likely due to the structural inhomogeneities of both thin films and single crystal. The room-temperature far-infrared reflectance of two thin films display a metallic character, with a stronger Drude response for $x = 0.68$. Notably, the Drude scattering rate at 20 K is found to approach zero, consistent with the small residual resistivity, indicating high quality of these two Na_xCoO_2 thin films.

REFERENCES

[1] H. Nakatsugawa and K. Nagasawa, J. Solid State Chem. 177, 1137 (2004).
[2] R. J. Balsys and R. L. Davis, Solid State Ionics 93, 279 (1996).
[3] Y. G. Shi et al., Phys. Rev. B 70, 052502 (2004).
[4] P. Lemmens et al., Appl. Phys. Lett. 75, 2456 (1999).
[5] F. Wooten, Optical Properties of Solids (Academic, New York, 1972).
[6] N. L. Wang et al., Phys. Rev. L 93, 237007 (2004).
[7] A. V. Puchkov et al., J. Phys.: Condens. Matter 8, 10049 (1996).
[8] D. Wu et al., Phys. Rev. B 73, 014523 (2006).