PE04

Evolution of Magnetic and Electronic Properties of Spinel $Cr_xFe_{3-x}O_4$ Thin Films

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In this study, by substituting Cr in Fe_3O_4, $Cr_xFe_{3-x}O_4$ thin film samples were prepared by sol-gel method on Si(100) substrates. The samples were found to be polycrystalline in nature and the Cr-doped ones maintained the same structure as that of Fe_3O_4 up to x = 0.95 without any secondary phases. The lattice constant is decreased slightly with increasing Cr composition with the value for x = 0.95 reduced by 0.05% compared to that of Fe_3O_4. The decrease of lattice constant can be explained in terms of substitution of octahedral Fe^{3+} sites by Cr^{3+} ions. The $Cr_xFe_{3-x}O_4$ films were found to exhibit n-type character with resistivity increasing with increasing Cr content.

Magnetic hysteresis curves of the samples measured at room temperature indicate that the saturation magnetization (M_s) increase at low Cr composition ($x \leq 0.05$) and decrease as x increases further. On the other hand, the coercivity (H_c) increases as x increases. Simple comparison of the spin magnetic moment of Cr^{3+} and Fe^{3+} ions can not explain the increase of M_s. The increase of M_s is attributable to the unquenched orbital angular momentum of octahedral Fe^{2+} ion [1] due to perturbation of octahedral Cr^{3+} ions existing nearby. The increase of Hc is attributed to the increase of magnetic anisotropy by the existence of octahedral $Cr^{3+}(d^3)$ ions. Magnetoresistance of $Cr_xFe_{3-x}O_4$ films is found to decrease with increasing x as shown in Fig. 1 and the probable reason for it is discussed.

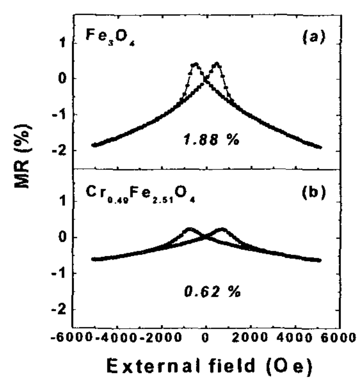

Fig. 1. Magnetoresistance measured for (a) Fe_3O_4 and (b) $Cr_{0.49}Fe_{2.51}O_4$ thin films at room temperature.

REFERENCES
[1] D. J. Huang, C. F. Chang, H.-T. Jeng, G. Y. Guo, H.-J. Lin, W. B. Wu, H. C. Ku, A. Fujimori, Y. Takahashi, and C. T. Chen, Phys. Rev. Lett. 93, 077204 (2004).

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Interaction Energy Changed by Substituting Potassium in Li-ferrites

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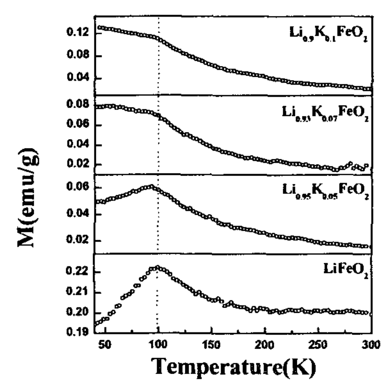

Fig. 1. Temperature dependence of magnetization of *$Li_{1-x}K_xFeO_2$ in zero field-cooling(ZFC).*

The commercial lithium battery has been studied vigorously power source for portable electronics. Lithium iron oxides has drawn much interests for the higher energydensity and the extended life cycle for applications. However crystallization of lithium iron oxide during has been the problem[1]. In this work, $Li_{1-x}K_xFeO_2$ powders have been prepared by a sol-gel method. Their crystallographic and magnetic properties fabrication process have been studied by X-ray diffraction (XRD), Mössbauer spectroscopy, and vibrating sample magnetometer (VSM) measurements. The single-phase of $Li_{1-x}K_xFeO_2$ is observed in the samples annealed at 650℃ for 3h in air atmosphere. The crystal structure of $Li_{1-x}K_xFeO_2$ is found to be cubic structure of *Fm3m* with its lattice constants a_0 = 4.161 Å by Reitveld refinement. The VSM measurements were performed in the temperature range from 40 to 300 K, which was finded the Néel temperature (T_N = 97 K ± 5 K). Magnetic behaviour was changing from the antiferromagnetic property to the ferrous property with increasing potassium concentration as shown in Fig. 1. By the SEM measurment, We have observed uniform distribution of grains with spherical shape. The paticle size of the powders show that it decreases with increasing potassium concentration.

REFERENCES
[1] H. M. Widatallah, and Frank J. Berry, Solid State Chem. 164, 230 (2002).
[2] S. Y. An, I. B. Shim, C. S. Kim, J. Magn. Magn. Mater. 290, 1551 (2005).