SA07

Carrier Doping Dependence of the T_c in Double Perovskite Sr_2FeMoO_6

J. Kim[1], C. S. Kim[2], and B. W. Lee[1]*

[1]Department of Physics, Hankuk University of Foreign Studies, Yongin, kyungki, 449-791, Korea
[2]Department of Physics, Kookmin University, Seoul 136-702, Korea

*Corresponding author: bwlee@hufs.ac.kr, Phone: +82 31 330 4362, Fax: +82 31 330 4566

We have studied effects of the electron doping on the magnetic phase transition in double perovskites $Sr_{2-x}A_xFeMoO_6$ (A= Ca and La). Polycrystalline samples were prepared by standard solid-state reaction. X-ray diffraction patterns reveal that samples are single-phase with tetragonal I_4/mmm symmetry. In SCFMO, the T_c decreases from 377 K for x=0 to 365 K for x=0.1 with Ca doping. However, the T_c of SLFMO increases from 377 K for x=0 to 390 K for x=0.1 with La doping. Since the ionic radii of Ca^{2+} ion (1.34 Å) and La^{3+} ion (1.36 Å) are almost same, considering ionic size effect, we cannot expect any difference in T_c between A=Ca and La with increasing x. Contrary to the case for A=Ca, the substitution of La^{3+} for Sr^{2+} introduces electrons in the electronic systems, which changes the valence state of Fe/Mo ions. Hall effect measurement shows the normal Hall coefficient for A=La is negative, so that the increase of T_c with La^{3+} doping originates from electron doping effects.

SA08

Improper Ferroelectric Phase Transition of Perovskite Rare-Earth Magnites

L. Dai and Q. Jiang

Department of Physics, Suzhou University, Suzhou 215006, China

*Corresponding author: qjiang@suda.edu.cn, Phone: +86 512 65112597 6632, Fax: +86 512 65112597

As for members of recently discovered multiferroics, the coexistence of magnetic and electric order in $RMnO_3$, which contains Mn^{3+} ion with occupied d orbital and no lone s^2 cation, can not been explained by conventional mechanism. The theoretical and experimental studies of $RMnO_3$ revealed that the competing magnetic interactions give rise to a long-wavelength AF spin order and according lattice modulation with nonzero wave vector through magnetoelastic coupling. The corresponding lattice modulation with wave number k_l ($\sim 2k_{Mn}$) can be regarded as a second harmonic of sinusoidal AF structure. The strong interplay of lattice modulation and magnetic order, strongly suggest the spin structure is closely related with the ferroelectricity in orthorhombic $RMnO_3$ compounds. The ferroelectricity originates from the coupling between magnetic order and lattice distortions.

We develop a phenomenological Landau theory of improper ferroelectric phase transition to investigate magnetoelectric properties of $TbMnO_3$. We show that appearing of the magnetic moment of Mn as one of the primary order parameter is the key to the appearance of polarization, and its rotating is responsible for magnetic-field-induced polarization flop. Our theoretical results are in good agreement with the experimental data (the date in Fig.2. from Ref.1)

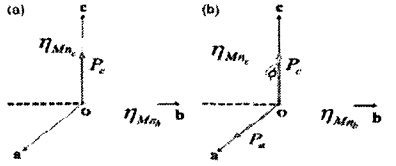

Fig. 1. the spontaneous polarization rotating in the ac plane: (a) H_b=0, (b) $H_b \neq 0$.

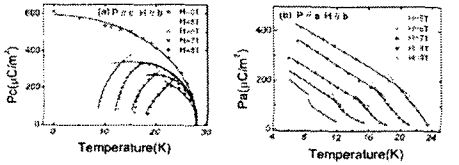

Fig. 2. The spontaneous polarization as a function of the temperature in applied magnetic fields: (a) P_c, (b) P_a

REFERENCES

[1] T. Kimura, T. Goto, H. Shintane, K. Ishizaka, T. Arima, and Y. Tokura, Nature (London) **426**, 55 (2003).
[2] Kimura, G. Lawes, T. Goto, Y. Tokura, and A. P. Ramirez, Phys. Rev. B **71**, 224425 (2005).
[3] T. Goto, T. Kirmura, G. Lawes, A.P. Ramirez, and Y. Tokura, Phys. Rev. Lett. **92**, 257201 (2004)