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# Improved Magnetic Anisotropy of $YMn_{1-x}Cr_xO_3$ Compounds

**Y. J. Yoo[1], J. S. Park[2], J. -H. Kang[3], J. Kim[4], B. W. Lee[4], K. W. Kim[5], Y. P. Lee[1]**

[1]Department of Physics, Hanyang University, Seoul, [2]Institute of Basic Sciences and Department of Physics, Sungkyunkwan University, Suwon 446-740, [3]Department of Nano & Electronic Physics, Kookmin University, Seoul, [4]Department of Physics, Hankuk University of Foreign Studies, Yongin, [5]Sunmoon University, Asan, Korea

Recently, hexagonal manganites have attracted much attention because of the coexistence of ferroelectricity and antiferromagnetic (AFM) order. The crystal structure of hexagonal manganites consists of $MnO_5$ polyhedra in which $Mn^{3+}$ ion is surrounded by three oxygen atoms in plane and two apical oxygen ions. The Mn ions within Mn-O plane form a triangular lattice and couple the spins through the AFM superexchange interaction. Due to incomplete AFM coupling between neighboring Mn ions in the triangular lattice, the system forms a geometrically-frustrated magnetic state.

Among hexagonal manganites, $YMnO_3$, in particular, is the best known experimentally since the f states are empty. In addition, for applications, $YMnO_3$ thin films have been known as promising candidates for non-volatile ferroelectric random access memories. However, $YMnO_3$ has low magnetic order temperature (～70 K) and A-type AFM structure, which hinders its applications.

We have synthesized $YMn_{1-x}Cr_xO_3$ (x = 0, 0.05 and 0.1) samples by the conventional solid-state reaction. The powders of stoichiometric proportions were mixed, and calcined at 900°C for $YMn_{1-x}Cr_xO_3$ for 24 h. The obtained powders were ground, and pressed into 5-mm-thick disks of 1/2-inch diameter. The disks were directly put into the oven, and heated up to 1,300°C and sintered in air for 24 h. The phase of samples was checked at room temperature by powder x-ray diffraction using a Rigaku Miniflex diffractometer with Cu $K\alpha$ radiation. All the magnetization measurements were carried out with a superconducting quantum-interference-device magnetometer. Our experiments point out that the Cr-doped samples show the characteristics of a spin-glass state at low temperatures.

**Keywords:** Multiferroic, $YMnO_3$, Structural properties, Magnetic properties