Magnetic, Transport, and Structural Studies of Manganites

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Beamline(s) **X18B, X23A2**

Introduction: As a function of temperature, pressure, doping, and A^{3+}/A'^{2+}-site ionic radius, perovskite mixed-valent manganites $A^{3+}_{1-x}A'^{2+}_{x}MnO_3$ (e.g. A^{3+} = Bi, La, Pr, Nd, etc. and A'^{2+} = Ca, Sr, Ba, Pb, etc.) show intriguing properties such as: structural transformations, charge ordering, metal-insulator transitions and magnetic ordering (ferromagnetic (FM) -antiferromagnetic (AF)) transformations. [1]

Methods and Materials: We have prepared a series of BCMO ($x \geq 0.4$) polycrystalline samples using the standard solid-state reaction method. Stoichimetric mixtures of Bi_2O_3, $CaCO_3$ and MnO_2 were mixed, ground, and pressed into pellets which were calcined at 900 ºC. After calcination, the samples were reground and sintered at 1000 ºC in air. X-ray absorption spectra were measured at X18B and X23A2.

Results: Detailed magnetization measurements were performed as a function of field and temperature to explore the net moment on the Mn sites as a function of x and reveal the charge ordering and Néel temperatures. X-ray absorption measurements reveal significant structural distortion in the Mn-O bond distributions with increasing Bi content which correlates directly with increasing charge ordering temperatures. Representative raw x-ray absorption spectra data are shown in Fig. 1 as an inset for x = 0.9. Note that only small changes in amplitude occur with temperature.

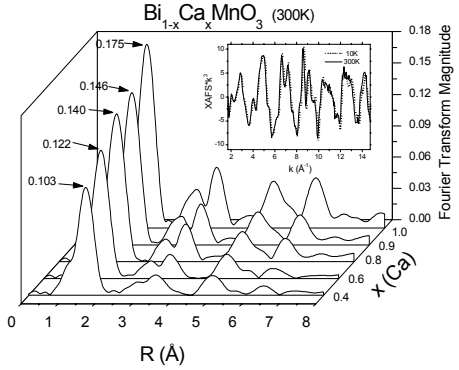

Figure 1. Magnitude of the Fourier transform of XAFS*k^3 of BCMO ($2.5Å^{-1} \leq k \leq 12.3Å^{-1}$).

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References: [1] Y. Tokura, Y. Tomioka, J. Magn. Magn. Mater. **200**, 1 (1999); J. M. D. Coey, M. Viret, and S. von Molnar, Adv. Phys. **48**, 167 (1999).