Study on Magnetic Domain Dynamics of Magnetocalorimetric Thin Film Materials

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We have investigated magnetic and magnetocaloric properties of $Ba_{1.7}La_{0.3}FeMoO_6$ and $Sr_{2-x}Ba_xFeMoO_6$ with double Perovskite structure. The samples have been fabricated by a standard solid state reaction technique and structural properties were examined by X-ray diffraction measurement, all of which were carried out by NASB collaborators. The magnetic and magnetocaloric properties have been explored, first by low-temperature vibrating sample magnetometer (VSM). Temperature-dependent M(T) and dM/dT curves under an applied field of 100 Oe are shown in Fig. 1, where ferromagnetic-paramagnetic phase transition is clearly observed around the Curie temperature about 345 K.

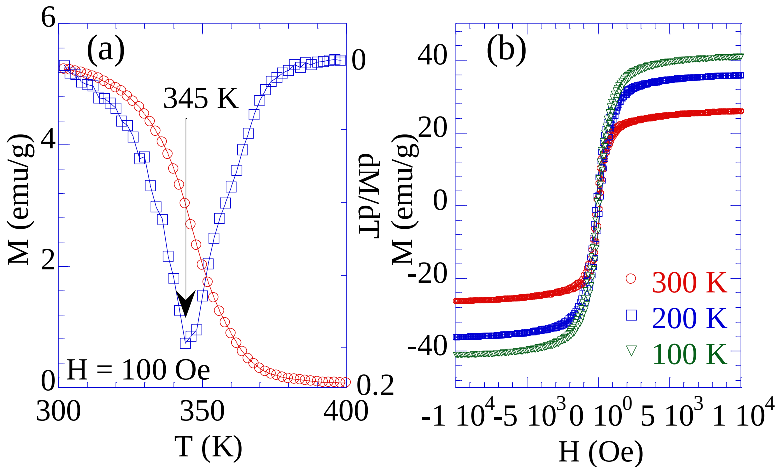

Fig. 1. Temperature-dependent M(T) and dM/dT for $Ba_{1.7}La_{0.3}FeMoO_6$ compound sample. [1]

To further understand the transition behavior, the critical behavior around the Tc has been analyzed by Arrot plot method, where the transition here undergoes with second-order transition, as demonstrated in Fig. 2. The critical scaling exponents experimentally determined are compared to the predicted values from several theories.

Secondly, the target materials of $Sr_{2-x}Ba_xFeMoO_6$ (x = 0, 0.2, 0.4, and 0.6) have been successfully fabricated by NASB collaborators. The thin films were deposited on $SrTiO_3$ substrate by the pulsed laser deposition technique at the substrate temperature of 800 ^oC with Oxygen partial pressure of 150 mTorr. Various magnetic properties will be examined by low-temperature VSM, ferromagnetic resonance, and magneto-optical Kerr effect. Magnetic imaging by means of magneto-optical Kerr microscopy and magnetic force microscopy will be carried out for the samples, thereby providing details of microscopic correlation between magnetic domain structures and magnetocaloric behavior around the Tc.

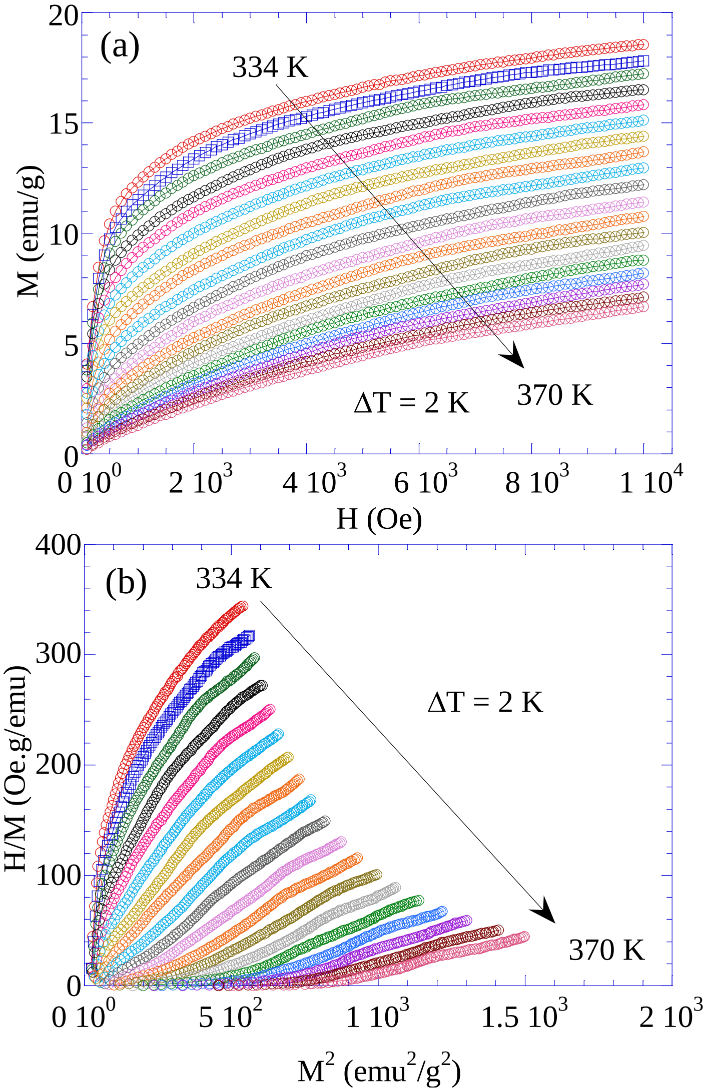

Fig. 2. (a) Field dependent magnetization under various temperature. (b) Arrott plots with H/M vs. M^2 for $Ba_{1.7}La_{0.3}FeMoO_6$. [1]

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References

[1] T. D. Thanh, S. K. Oh, D.-H. Kim, S.-C. Yu, S. E. Demyanov, N. A. Kalanda, M. V. Yarmolich, and L. V. Kovalev, in preparation