Finite-Size Scaling Effects in Chromia thin films

WILL ECHT-ENKAMP, XI HE, CHRISTIAN BINEK, Department of Physics and Astronomy and Nebraska Center for Materials and Nanoscience, University of Nebraska-Lincoln — Controlling magnetism by electrical means remains a key challenge in the area of spintronics. The use of magnetoelectrically active materials is one of the most promising approaches to this problem. Utilizing Cr$_2$O$_3$ as the magnetoelectric pinning layer in a magnetic heterostructure both temperature assisted and isothermal electrical control of exchange bias have been achieved [1,2]. Interestingly, this ME switching of exchange bias has only been achieved using bulk Cr$_2$O$_3$ crystals, isothermal switching of exchange bias using thin film chromia remains elusive. We investigate the origin of unusually pronounced finite-size scaling effects on the properties of Cr$_2$O$_3$ grown by Molecular Beam Epitaxy; in particular we focus on the different temperature dependencies of the magnetic susceptibility of bulk vs. thin film chromia, the change in Néel temperatures, and the implications for the magnetoelectric properties of chromia thin films.


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