Competing magnetic interactions in magnetoelectric YbMnO3

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Abstract: We present studies of magnetization and heat capacity of a single crystal of YbMnO3 in variable temperature and magnetic field, and clarify several new aspects of the magnetic field- temperature phase diagram. YbMnO 3 is a rare-earth manganite oxide with hexagonal crystal symmetry in which two multiferroic ordered states - ferroelectricity and antiferromagnetism - coexist at low temperature. Single crystals of YbMnO3 were carefully grown from a Floating Zone (FZ) at low speed, then oriented and studied with the magnetic field oriented along the caxis. Magnetization and heat capacity measurement show features corresponding to long range anti-ferromagnetic (AFM) ordering of Mn3+, and the rare earth Yb 3+. The ordering temperature of Mn3+ is independent of applied magnetic field up to 5T. However, contrary to previous reports in flux-grown crystals, we do not observe a complete suppression of Yb3 order above 0.1 T. Instead, we find that Yb3+ remains ordered at least up to 1 T, suggesting a revision of our current understanding of the ordering mechanism of the Mn-Yb and Yb -Yb sub-lattices in this hexagonal structure.

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