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Fingerprints of surface magnetism in Cr_2O_3 based exchange bias heterostructures XI HE, YI WANG, CH. BINEK, University of Nebraska-Lincoln — Magnetoelectric materials experienced a recent revival as promising components of novel spintronic devices [1, 2, 3]. Since the magnetoelectric (ME) effect is relativistically small in traditional antiferromagnetic (AF) compounds like Cr_2O_3 (max. αzz $\approx$4ps/m) and also cross-coupling between ferroic order parameters is typically small in the modern multiferroics, it is a challenge to electrically induce sufficient magnetization required for the envisioned device applications. In exchange bias systems the bias field depends critically on the AF interface magnetization. Hence, a strong relation between the latter and the surface magnetization of the free Cr_2O_3pinning layer can be expected. Our recent research indicates that there are surface magnetic phase transitions in free Cr_2O_3 (111) films accompanying surface structural phase transitions. Well defined AF interface magnetization is initialized through ME annealing to T=20K. Subsequently, the interface magnetization is thermally driven through phase transitions at T=120 and 210K. Their effects on the exchange bias are studied in Cr_2O_3 (111)/CoPt films with the help of polar Kerr and SQUID magnetometry. [1] P. Borisov et al. Phys. Rev. Lett. 94, 117203 (2005). [2] Ch. Binek, B.Doudin, J. Phys. Condens. Matter 17, L39 (2005). [3] R. Ramesh et al. 2007 *Nature Materials* 6 21. Financial support by NSF through Career DMR-0547887, MRSEC DMR-0820521 and the NRI.

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