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Ferromagnetic boundary magnetization properties of epitaxial $\mathbf{Cr_{(2-x)}Al_{(x)}O_3}$ thin films LORENZO FALLARINO, CIC nanoGUNE Consolider, CHRISTIAN BINEK, University of Nebraska - Lincoln, ANDREAS BERGER, CIC nanoGUNE Consolider — The existence of an equilibrium net magnetization at (0001) surfaces is enabled by symmetry constrains for the magnetoelectric antiferromagnet α-Cr_2O_3. The occurrence of this boundary magnetization (BM) is furthermore roughness insensitive [1]. The BM is hereby fully coupled to the bulk antiferromagnetic order parameter and can be reversed together with it by a combination of E and H fields in bulk materials [2], or solely by magnetic means for single crystal (0001) oriented thin chromia films [3]. In order to understand whether the BM can be extended to alloys containing different oxide materials, we investigated the effect of Al_2O_3 doping onto the structural and magnetic properties of α-Cr_2O_3. We grew, using a hybrid growth procedure, 100 nm thick high-quality epitaxial $Cr_{2-x}Al_xO_3$(0001) thin films in the concentration range between x=0 to x=0.6, preserving the original corundum crystal structure and symmetry. Using SQUID magnetometry, we showed that the critical temperature T_N can be tuned by alloying with α-Al_2O_3 using the BM as a probe to study the magnetic transition. Furthermore, we were able to evaluate the critical exponent and the absolute BM values for different samples. Both properties are consistent with the expected values, corroborating the BM nature of the observed magnetic signals. References: [1] K. D. Belashchenko, Phys. Rev. Lett. **105**, 147204 (2010); [2] X. He et al., Nat. Mater. **9**,579 (2010); [3] L. Fallarino et al., Appl. Phys. Lett. **104**, 022403 (2014)

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