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Morphology and Magnetism of Atomically Thin Layers of Chromia – An STM Investigation XUMIN CHEN, DONNA KENKEL, GEOFFREY ROJAS, XI HE, CHRISTIAN BINEK, AXEL ENDERS, University of Nebraska-Lincoln, MSREC COLLABORATION — A low temperature scanning tunneling microscopy (LT-STM) study of ultrathin chromium oxide films on Cu(111) is presented. The (0001) surface of Cr_2O_3 (chromia) exhibits long-range antiferromagnetic ordering, and its usefulness for electric field control of exchange bias has been recently established [Xi He, Ch. Binek, et al., Natuer Materials 9, 579 – 585 (2010)]. We deposited ultrathin chromium layers on Cu(111), followed by post-annealing in oxygen partial pressures to promote oxidation of the chromium films. We find that chromium grows on Cu(111) in the Volmer-Weber mode, resulting in small 3D islands. During annealing, the small islands coalesce to form large, flat terraces and the most stable oxide of chromium, Cr_2O_3, is formed at 630 $^\circ$C. Spin-polarized scanning tunneling microscopy has been performed to image the layer-wise antiferromagnetism in different structural layers of the chromia films. Thin layers of cobalt have been deposited on the chromia so that the magnetism of the Co couples to that of the chromia. Imaging the magnetism of the Co islands on the Cr_2O_3 terraces with spin-polarized STM helped us distinguishing between magnetic and electronic contrast in the complex dI/dV maps of the chromia surface.

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