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Electronic structure of epitaxial CrO_2(100) and CrO_2(110) films
C. A. VENTRICE JR, H. GEISLER, Texas State Univ., D. R. BORST, Univ. of New Orleans, G. X. MIAO, A. GUPTA, Univ. of Alabama — Half-metallic ferromagnets are conducting solids whose conduction electrons undergo magnetic ordering with a spin polarization of 100% at 0 K. Although CrO_2 is predicted to be a half-metallic ferromagnet, previous attempts to make devices using CrO_2 have resulted in a degradation of performance instead of an enhancement. Using ultraviolet photoelectron spectroscopy at the CAMD synchrotron, we have measured the electronic properties of epitaxial CrO_2(110)/TiO_2(110) and CrO_2(100)/TiO_2(100) surfaces grown using a CrO_3 precursor. Clean, stoichiometric CrO_2 surfaces have been prepared either by exposure to white light, which desorbs OH groups from the surface, or by sputtering and annealing in O_2. The measurements of the CrO_2 surfaces show no emission at E_F after sputtering and annealing the surfaces in oxygen. However, the white light prepared surfaces show a small density of states at E_F. Photon energy dependent photoemission experiments show no increase in the density of states at E_F as the photon energy is lowered from 50 eV to 15 eV, which increases the bulk sensitivity of these measurements. These results indicate that CrO_2 behaves more like a semi-metal than a half-metal and that surface disorder can induce a semi-metal to semiconductor transition at its surfaces.

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