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Epitaxy of polar semiconductor Co_3O_4 (110): growth, structure, and characterization KRISTY KORMONDY, AGHAM POSADAS, ALEXANDER SLEPKO[1], University of Texas at Austin, AJIT DHAMDHERE, DAVID SMITH, Arizona State University, KHADIJIH MITCHELL, STEFAN ZOLLNER, New Mexico State University, LUKE MARSHALL, JIANSHI ZHOU, ALEXANDER DEMKOV, University of Texas at Austin — The (110) plane of catalytic Co_3O_4 exhibits significantly higher rates of carbon monoxide conversion due to the presence of active Co^{3+} species at the surface. However, experimental studies of Co_3O_4 (110) surfaces and interfaces have been limited due to the difficulties in growing high-quality films. In this paper, we present thin (1- 25nm) Co_3O_4 films grown by molecular beam epitaxy in the polar (110) direction on $MgAl_2O_4$ substrates. Reflection high-energy electron diffraction, atomic force microscopy, x-ray diffraction, and transmission electron microscopy measurements attest to the high quality of the as-grown films. We note that the film surface roughens at intermediate thickness, but slowly smoothens as growth continues, returning to an RMS surface roughness less than 1 Å. Furthermore, we investigate the electronic structure and optical properties of this material by core level and valence band x-ray photoelectron spectroscopy, first-principles density functional theory calculations, and ellipsometry. A valence band offset of 3.5 eV is measured for the $Co_3O_4/MgAl_2O_4$ heterostructure. Magnetic measurements show the signature of antiferromagnetic ordering at 46 K.

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