Title: Electronic Structure of Thin Film Anatase TiO_2: A Candidate Spintronics Material

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Description: The anatase form of titanium dioxide (TiO_2) is a wide band-gap oxide semiconductor that is nearly lattice-matched to Si (001). Anatase can be made ferromagnetic at room temperature by doping with a few percent of cobalt, and is thus of interest as a potential spin injector for silicon in spintronics. In this system, the interesting physics occur over distances on the order of a few tenths to a few lattice spacings in the crystalline solids. This research will primarily focus on correlating the magnetic, electronic, and atomic structure of doped and un-doped TiO_2. Thin (<100 nm) films of anatase are grown on $LaA1O_3$ (001) (lattice mismatch -0.26%), $srTiO_3$ (001) (lattice mismatch -3.1%), and $SrTiO_3$/Si (001) at PNNL using oxygen plasma assisted molecular beam epitaxy (OPA-MBE). The impact of lattice mismatch with the different substrates will be probed as well. The electronic band structure will be determined using near-edge x-ray absorption fine structure (NEXAFS), and high-resolution angle resolved photoelectron spectroscopy (ARPES). Other techniques such as XPD and LEED will be used to determine any possible surface reconstructions, while XPS will be used to determine the local chemical environment of the constituent atoms. The electronic structure will also be examined for any changes in the presence of a magnetic field.