Characteristics of $Ti_{1-x}Co_xO_2$ Thin Films Deposited by MOCVD

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Polycrystalline thin films of $Ti_{1-x}Co_xO_2$ were prepared on TiO_2 (50nm)/Si (111), YSZ, and Al_2O_3 substrates using liquid delivery metal organic chemical vapor deposition (MOCVD). This growth technique allows for the arbitrary variation of the Co concentration. The precursors for these growths were titanium isopropoxide and $Co(TMHD)_3$ dissolved in tetrahydrofuran. These films were characterized by X-ray absorption spectroscopy (XAS) and X-ray magnetic circular dichroism (XMCD) to determine the phase of the TiO_2 host, the Co valency, and the presence of Co clusters. Film thicknesses and Co dopant concentrations were determined from Rutherford backscattering (RBS). A vibrating sample magnetometer (VSM) revealed room temperature ferromagnetism, allowing for a determination of the moment per Co atom vs. Co concentration. Results from air and vacuum annealing studies for a range of temperatures will be shown. I will discuss these results in the context of the bound magnetic polaron model. Recent work [1] suggests that this model may only need oxygen vacancies and ferromagnetism may occur with nonmagnetic doping. Our experimental results on Pt:TiO_2 and its lack of ferromagnetism will also be presented.

[1] Osorio-Guillen, J., Lany, S., Barabash, S. V. and Zunger, A., Phys. Rev. Lett., 96,
107203 (2006)