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Insulating room temperature ferromagnetic $SrTiO_3$ AGHAM POSADAS, CHANDRIMA MITRA, CHUNGWEI LIN, University of Texas at Austin, AJIT DHAMDERE, DAVID SMITH, Arizona State University, MAXIM TSOI, ALEX DEMKOV, University of Texas at Austin — We report the epitaxial growth of ferromagnetic insulating material based on $SrTiO_3$ using molecular beam epitaxy (MBE). $SrTi_{1-x}Co_xO_{3-\delta}$ films (x = 0.1 to 0.5) were grown on Si(100) substrates via a buffer layer of four unit cells of undoped $SrTiO_3$. The crystalline structure was characterized by reflection high energy electron diffraction, x-ray diffraction, and cross-section transmission electron microscopy. Robust room-temperature ferromagnetism is confirmed in samples with composition 30-40% Co. We also performed *in situ* x-ray photoelectron spectroscopy of the Sr, Co, Ti, and O core levels to determine stoichiometry and cobalt oxidation state. In all single phase samples, an oxygen vacancy concentration of approximately equal to the amount of Co substitution was measured (compensated doping). In order to elucidate the origin of ferromagnetism, we also performed first-principles calculations of $SrTiO_3$ simultaneously doped with Co and an oxygen vacancy. We find that such a configuration at concentrations of $\sim 25\%$ can result in a ferromagnetic insulating state with high spin Co^{2+}. The ability to integrate an insulating ferromagnet on silicon in epitaxial form may potentially be useful for spin filtering and spin wave applications in the field of spintronics.

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