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Defect Related Magnetism and Conduction in As-grown and Annealed Pulsed Laser Deposited SnO_2:Co Thin Films[1] GRATIELA M. STOIAN, Florida State University, P.A. STAMPE, R.J. KENNEDY, Florida A&M University, E. LOCHNER, Florida State University, Y. XIN, National High Magnetic Field Laboratory, Tallahassee, S. VON MOLNAR, Florida State University, FLORIDA STATE UNIVERSITY TEAM, FLORIDA A&M UNIVERSITY TEAM, NATIONAL HIGH MAGNETIC FIELD LABORATORY, FL COLLABORATION — Magnetic semiconductor SnO_2:Co films were grown on r-cut sapphire substrates via Pulsed Laser Deposition from a doped target with a nominal Co concentration of 5 at.%. To study the role of oxygen vacancies and other defects in tuning the ferromagnetic (FM) and electrical properties of these materials, films were deposited at different growth rates, temperatures and oxygen pressures. In addition, some films were annealed at various conditions. Magnetometry data show that films grown at optimal conditions are FM at room temperature with a saturation magnetization of 20 emu/cm^3. The moment per unit area varies linearly with the film thickness, suggesting the magnetism in our materials is a volume property. Magnetization decreases monotonically with the growth rate. A transition from a semiconducting, magnetic material to an insulating, non-magnetic material was observed below a film thickness of 50 Å. Annealing films grown at a higher than optimal deposition rate under the same conditions used for their growth, led to an initial rapid increase in the magnetization followed by constant magnetization after further annealing. We also report on the temperature dependence of the electro-magnetic properties.

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