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Controlling magnetic, magnetotransport and optical properties of Al codoped Zn-Co-O thin films PLAMEN STAMENOV, CRANN and School of Physics, Trinity College, Dublin 2, M. VENKATESAN, L. DORNELES, J.M.D. COEY, MANSE TEAM — Thin films of 5% Co doped ZnO were grown on C- and R-cut sapphire substrates by pulsed-laser deposition, with and without Al codoping (x=0–1% Al). Al-doped films retain significant magnetization while exhibiting degenerate semiconductor behaviour. Magnetoresistance of these novel Co-doped ZnO semiconductor films is found to be highly dependent on Al doping and is vanishingly small at (x >0.2 %) Large (∼20 % at 2 K) in-plane anisotropy of the magnetoresistance is observed, resembling an AMR effect, which is attributed to Fermi surface anisotropy and most of it has no "ferromagnetic" origin. The field dependence of the magnetoresistance can be explained in terms of two-band model and ionised impurity scattering. Hall-effect data indicates completely degenerate electron gas at (x > 0.5 %). High resolution x-ray scattering and magnetisation data on samples with (x=0) reviles the presence of Co metal clusters (∼8nm in size) that account for much or all the ferromagnetic magnetisation and exhibit temperature activated decrease of the coercive field. A huge band gap shift is observed with Al doping as a result of *Burstein-Moss* effect. In view of the vanishing magnetoresistive effects at room temperature, it is clear that these Co doped ZnO samples are not dilute magnetic semiconductors.

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