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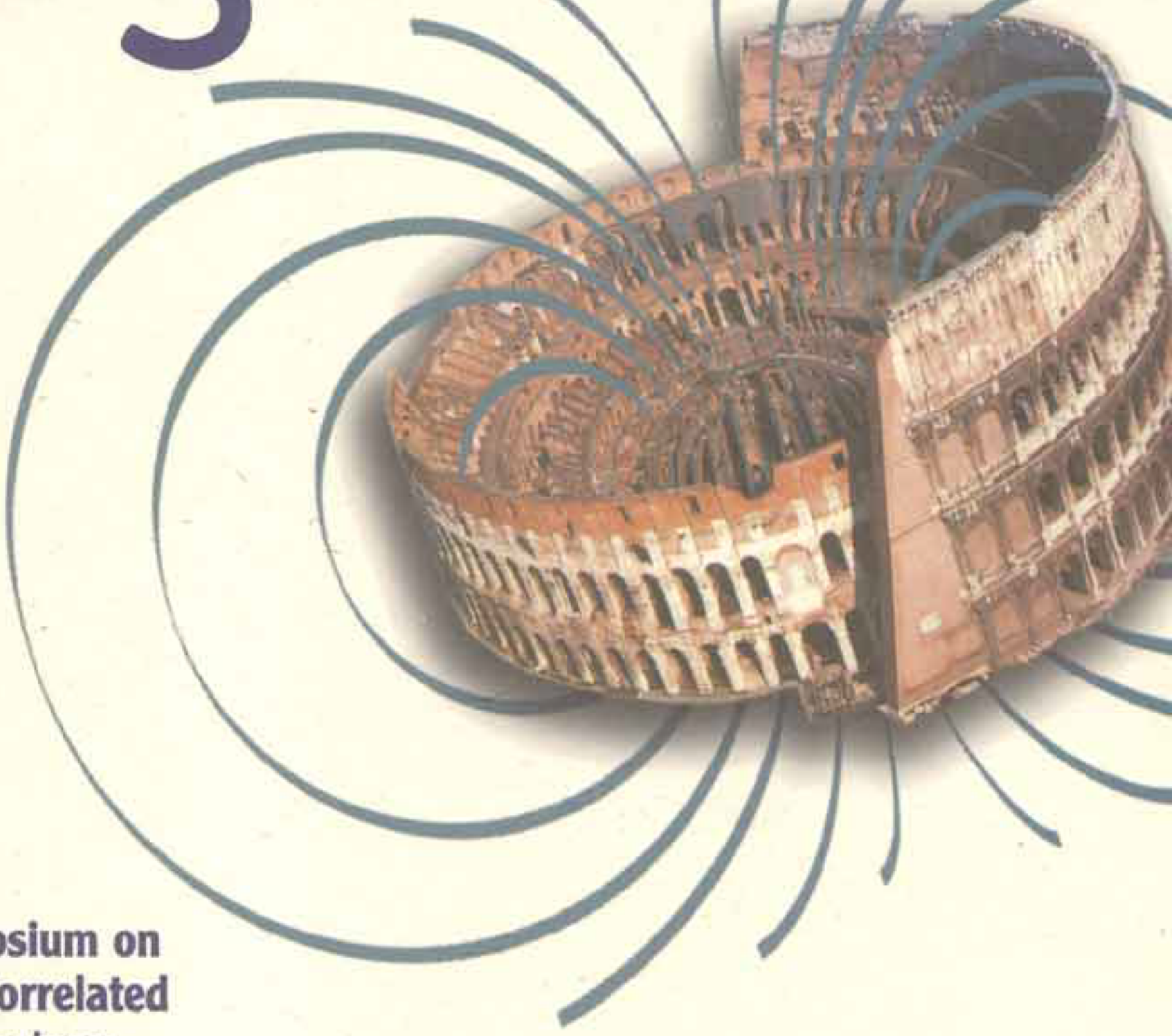

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abstracts

5U-am-28—— DOPING EFFECT OF INDIUM OXIDE-BASED DILUTED MAGNETIC SEMICONDUCTOR THIN FILMS.

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For the realization of spintronic device, it is essential to hybridize existing semiconductors with highly spin-polarized magnetic materials. Indium oxide is a wide-band-gap [energy gap E_g~3.70 eV] n-type semiconductor, which behaves as an insulator in its stoichiometric form (In_2O_3). This work is an experimental investigation at the effects of transition metal (TM= Cr, Mn, Fe, Co, and Ni) doping on the structural and magnetic properties of indium oxide. Pure and TR doped $In_{2-x}TM_xO_3(0.0\leq x\leq 1.0)$ nanostructure thin films have been successfully prepared by means of chemical solution process onto SiO_2/Si(100), Corning 7059 glass and MgO(100) substrates annealed at 600 °C in oxygen atmosphere. The XRD patterns of $In_{2-x}TM_xO_3$ thin films formed on the Si and glass substrates show that the films feature a cubic bixbyite structure with a_0=1.0117 nm, the orientation of the (222) crystal plane was predominant and the films on MgO(100) substrate showed a rocking curve full-wide at half maximum of 0.86 ° and found a "cube-to-cube" orientation relationship; MgO(001)||$In_{2-x}TM_xO_3$(001) ; MgO[100]||$In_{2-x}TM_xO_3$[100]. Microstructural characterization on thin film employing FE-SEM and AFM showed a granular structure with a mean grain size between 40 and 60 nm for all substrates and the surface roughness of typical thin films was 6 nm. Magnetic response was measured as a function of magnetic field strength for the $In_{2-x}TM_xO_3$ thin films on MgO(001) at temperature range of 77 to 300 K. Sharp, square hysteresis loops, indicating a well-ordered ferromagnetic structure, appeared in the magnetization versus magnetic field curves when magnetic field was applied in the plane of the film. This result clearly indicates that the $In_{2-x}TM_xO_3$ thin films are advantageous not only for practical application to magnetic device but also for physical basic studies on electro-magnetic properties $In_{2-x}TM_xO_3$ films.