INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

1-d undoped, ferromagnetic Co doped and non-magnetic Mg doped ZnO nanowires consisting of interconnected nanometer sized beads have been prepared by electrospinning method. Annealed as-spun undoped 1-d ZnO exhibited the highest ever achieved T_C of 885 K. Maximum magnetization of 0.039 emu/g was observed for 500 °C annealed sample at an applied field of 10 kOe. The observed room temperature ferromagnetism (RTFM) is due to singly ionized oxygen vacancies in undoped 1-d ZnO. Although no magnetization was observed in Mg doped 1-d ZnO, considerable enhancement in band gap energy was observed upon Mg^{2+} doping. Mg doping quenched the oxygen defects in 1-d ZnO. However, Co doped 1-d ZnO exhibited RTFM. Defects analysis revealed that exchange interaction between local spin-polarized electrons and conduction electrons of Co is responsible for RTFM in these nanostructures. Moreover, Zn vacancies present in the samples decreased upon increasing Co doping. 0-d and 1-d $CaFe_2O_4$ nanostructures have been prepared by sol-gel and electrospinning routes, respectively. Cubic $CaFe_2O_4$ nanoparticles slowly transformed to orthorhombic phase when annealed above 300 °C and the transformation completes at 1100 °C. Superparamagnetic behavior is associated with the cubic phase and weak ferrimagnetic behaviour was found in the orthorhombic phase. 1100 °C annealed orthorhombic 0-d $CaFe_2O_4$ exhibited Néel temperature at ~175 K. Co substitution in Ca site in 0-d $CaFe_2O_4$ improved its magnetic properties. Phase transformation from cubic to orthorhombic phase was also observed in 0-d $Ca_{0.9}Co_{0.1}Fe_2O_4$. 1-d cubic $CaFe_2O_4$ also slowly transformed to orthorhombic phase when annealed above 500 °C. Apart from clarifying the mechanisms responsible for RTFM in ZnO nanostructures, this work also revealed several new applications for these novel ZnO and $CaFe_2O_4$ nanostructures.