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Title of the Thesis: **Chemical Synthesis of Nano-sized Dilute Magnetic Semiconductors and their Properties**

Abstract: The work in the thesis is focused on the synthesis of nanosized dilute magnetic semiconductors with controlled size, shape and high surface area using low temperature solvothermal method through oxalate precursor route.

Chapter 1 discusses a detailed survey of the background of the thesis with an introduction to nanomaterials and dilute magnetic semiconductors followed by the synthetic techniques, characterization and properties which have been studied in the consequent chapters.

Chapter 2 discusses the microemulsion synthesis of solid solutions of $Zn_{1-x}Mn_xO$ (x = 0.05, 0.10 and 0.15) nanoparitcles using Tergitol NP-9 as the non-ionic surfactant. Hexagonal nanoparticles of the average grain size in the range of 20 to 50 nm which increases on increases the Mn concentration. The specific surface area of these nanoparticles was measured to be 202.6, 145.8 and 75.7 m^2g^{-1} respectively.

Chapter 3 discusses the solvothermal synthesis of $Zn_{1-x}M_xO$ (M = Mn, Ni, Co and x = 0.05, 0.10 and 0.15) dilute magnetic semiconducting nanoparticles through oxalate precursor route. In the chapter, we have also studied the effect of high manganese substitution at ZnO host lattice and investigated their optical and magnetic properties of $Zn_{1-x}Mn_xO$ (x = 0.31, 0.50 and 0.62) nanoparticles (2-10 nm) prepared by the modified solvothermal method for the first time.

In chapter 4, a simple and modified solvothermal method using oxalate precursor has been employed to synthesize monophasic and highly crystalline cubic $Cd_{1-x}Mn_xO$ ($0.04 < x < 0.1$), $Cd_{1-x}Ni_xO$ ($0.047 < x < 0.163$) and $Cd_{1-x}Co_xO$ ($0.04 < x < 0.15$) nanoparticles and their phase structure, morphology, optical and magnetic properties have been investigated. Results showed that particle size decreased from 25 to 18 nm and likely the surface area increased from 56 to 107 m^2g^{-1} on increasing the Mn concentration from x = 0.04 to 0.10. Similar decrease in particle size and increasing in surface area with increasing dopant ion concentration is also observed for Ni and Co-doped CdO nanoparticles.

In chapter 5, highly crystalline and monophasic cubic structure of $In_{2-x}M_xO_3$ (M= Mn, Ni, Co and x = 0.05, 0.10, 0.15) solid solutions with controlled size and high surface area have been successfully synthesized using modified solvothermal method through oxalate precursor route.

Chapter 6 discusses the solvothermal synthesis of $Sn_{1-x}M_xO_2$ (M = Mn, Ni, Co and x = 0.05, 0.10 and 0.15) nanoparticles with tetragonal structure using oxalate precursor route. The average particle size for Mn, Ni and Co-doped SnO_2 was found to be in the range of 5-20 nm. M-doped SnO_2 showed distinct magnetic behaviour with different dopant ion concentration. $Sn_{1-x}Mn_xO_2$ (x = 0.05 and 0.10) revealed the parasitic ferromagnetism, however on increasing x = 0.15, sample showed paramagnetism. Ni-doped SnO_2 at all concentrations showed paramagnetism with antiferromagnetic interaction. $Sn_{1-x}Co_xO_2$ (x = 0.05 and 0.10) nanoparticles also showed paramagnetism with antiferromagnetic interaction, however, on further increasing x = 0.15, the nanoparticles showed canted antiferromagnetic coupling.