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Structural and Magnetic Properties of Co Doped CeO_2 Nano-particle

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In the recent years, there has been a great deal of interest to develop materials that exhibits semiconducting as well as ferromagnetic properties known as dilute magnetic semiconductors (DMSs). In addition to their 'charge', the ferromagnetic semiconductors possess an additional degree of freedom and functionality of 'spin' which can be integrated into the existing semiconductors devices. The main challenge for the most of practical application of DMSs is the achievement of Curie temperature (T_C) well above the room temperature. However one of the key questions is whether the magnetic properties of these materials due to the substitution of the transition metal (TM) ions or clusters, precipitate or the secondary phase or oxygen vacancies. CeO_2, rare earth oxide insulator, is a key material used in many applications such as high k dielectric material in capacitors, a basis in the field effective transistors and as a buffer layer for silicon on insulator devices. These applications reflect that CeO_2 is good matrix to develop ferromagnetism. In the present work, we have synthesized Codoped CeO_2 using co-precipitation technique. All the chemical were dissolve in de-ionized water to get a 0.06 M solution with a molar ration of x = [Co]/(Co+Ce). In this solution, NH4OH solution was added until the pH level reached 9. This mixture was stirred for 3 hours at room temperature and then filtered. Precipitate was dried at 80 ^oC for 14 hours and then annealed at 500 ^oC for 4 hours to obtain the nano particles of $Ce_{1-x}Co_xO_2$. The prepared nano-particles were characterized by the x-ray diffraction field emission electron microscopy and dc magnetization hysteresis loop measurements. From the x-ray diffraction analysis it observed that all sample exhibits single phase polycrystalline nature. FESEM micrograph infers that particle size is ~10 nm. Magnetization results indicated that the room temperature ferromagnetism observed in Co doped CeO_2 nanoparticles originates from a combination effect of oxygen vacancies and transition metal doping.

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