Synthesis and magnetic properties of pure and cobalt-doped nanocrystalline bismuth ferrite

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Abstract: Applications of nanocrystalline multiferroics in sensor development, massive memory storage or in the fabrication of new devices taking advantage of the electron charge and spin explains the need of investigating various options to synthesize these types of materials. Among promising candidates, Bismuth ferrite (BiFeO3) is a multiferroic material that exhibits ferromagnetism, ferroelectricity and ferroelasticity. The present research is focused on the systematic study of the polyol synthesis of substrate-less nanocrystalline BiFeO3 particles and its structural and magnetic characterization. As an attempt to explore the possibility of tuning the ferrite magnetic properties, host BiFeO3 was doped with cobalt ions in the 5at. % -10at. % range. Our results suggested that the ferrite formation and its properties were strongly dependent on both, the annealing conditions of the precursors and the concentration of cobalt species. Well-crystallized pure BiFeO3 was produced after annealing the precursor powders for one hour at 800°C Doping with cobalt ions lowered the temperature at which the nanocrystalline BiFeO3 host structure was developed. The saturation magnetization and coercivity in the nanocrystalline ferrite were strongly influenced by the selected annealing temperatures and dopant concentration. These magnetic parameters varied from 0.30 emu/g and 109.5 Oe up to 4.2 emu/g and 988 Oe for pure and 10 at % Co-doped ferrite, respectively.

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