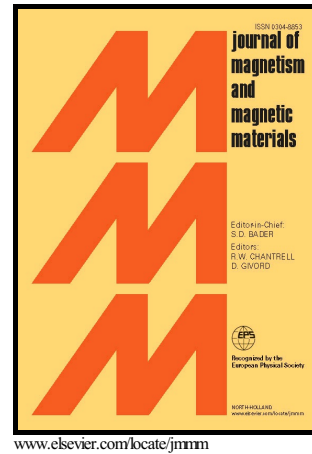


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Effect of bismuth doping on the structural and magnetic properties of zinc-ferrite nanoparticles prepared by a microwave combustion method

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Abstract

In this study, we examine the bismuth doping effect on the structural, magnetic and microstructural properties of zinc-ferrite nanoparticles ($\text{ZnFe}_{2-x}\text{Bi}_x\text{O}_4$ $x= 0.0, 0.02, 0.04, 0.06, 0.1, 0.15$) which have been prepared by a microwave combustion method. The structural, morphological and electromagnetic properties and also Curie temperature of the samples were examined by x-ray powder diffraction (XRD), field emission scanning electron microscope (FESEM), vibrating sample magnetometer (VSM), and LCR meter, respectively. In order to measure the energy band gap, the FTIR spectra of the samples were also considered. The XRD patterns of the samples revealed that all of them are ZnFe_2O_4 structure and no additional peak was observed in their patterns. This implied that the samples were single-phase up to bismuth solubility of 0.15 in Zinc-Ferrite. The results of XRD patterns also showed that the value lattice parameter increases with increasing the bismuth doping. The FESEM results revealed an ascending trend in the size of the nanoparticles. Also considering the VSM results characterized that an increasing the bismuth doping leads to lower the saturation magnetization. The Curie temperatures of the samples were reduced as a result of increasing the amount of bismuth.

Keywords: zinc-ferrite nanoparticles; bismuth; magnetic properties; microwave combustion method

1. Introduction

Scientific researches related to ferrites began at the 19th century. Thereafter, serious research considering the industrial applications of these materials were followed by two Japanese scientists named T. Takeshi and K. Yogoro and the results of their researches on copper and cobalt ferrites were published in 1932. Scientific research has been spread out after that, and other scientists did some experiments on various compounds of iron, nickel, manganese and zinc oxides and achieved good results

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