

Physical and magnetic characterization of polycrystalline cobalt ferrite (CoFe₂O₄) materials prepared via mechanically alloyed nanoparticles.

Abstract

Nanoparticle-size d cobalt ferrites (CoFe₂O₄) were prepared via high energy mechanical alloying using a Spex8000D mixer/mill and heat treatment. The starting raw materials Co₃O₄ and Fe₃O₄ were milled for 12 hours in air, molded into samples of toroidal and disc shape and subsequently sintered at various temperatures from 600 to 1000 °C. The effect of sintering temperature on microstructure, magnetic and dielectric properties like saturation magnetic moment (M_s), coercivity (H_c), retentivity (M_r) permittivity and permeability were investigated in the frequency range 10 MHz to 1.8 GHz. The results show that single phase cobalt ferrites could not be formed during milling alone, however it formed at 600 °C. The crystallization of the cobalt ferrites was seen to increase strongly up to 1000°C. Further observed was that the crystallite size increased with the increasing sintering temperature. A high coercivity of up to 1982 Oe and a magnetization of 47 emu/g were obtained after an optimized heat treatment at 800 and 900°C respectively.

Keyword: Mechanical alloying; Cobalt ferrites; Sintering temperature.