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Microwave-assisted solution synthesis, microwave sintering and magnetic properties of cobalt ferrite

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ABSTRACT

A simple, soft, and fast microwave-assisted hydrothermal method was used for the preparation of nanocrystalline cobalt ferrite powders from commercially-available $Fe(NO_3)_3 \cdot 9H_2O$, $Co(NO_3)_2 \cdot 6H_2O$, ammonium hydroxide, and tetrapropylammonium hydroxide (TPAH). The synthesis was conducted in a sealed-vessel microwave reactor specifically designed for synthetic applications, and the resulting products were characterized by XRD, FE-SEM, TEM, and HR-TEM. After a systematic study of the influence of the microwave variables (temperature, reaction time and nature of the bases), highly crystalline $CoFe_2O_4$ nanoparticles with a high uniformity in morphology and size, were directly obtained by heating at 130°C for 20 min using the base TPAH. Dense ceramics of cobalt ferrite were prepared by non-conventional, microwave sintering of synthesized nanopowders at temperatures of 850-900ºC. The magnetic properties of both the nanopowders and the sintered specimens were determined in order to establish their feasibility as a permanent magnet.

Keywords: Microwave-assisted solution synthesis; Microwave sintering; Magnetic properties; Cobalt ferrite