

Accepted Manuscript

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

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PII: S0955-2219(17)30859-2
DOI: <https://doi.org/10.1016/j.jeurceramsoc.2017.12.052>
Reference: JECS 11657

To appear in: *Journal of the European Ceramic Society*

Received date: 6-7-2017
Revised date: 20-12-2017
Accepted date: 24-12-2017

Please cite this article as: Fariñas JC, Moreno R, Pérez A, García MA, García-Hernández M, Salvador MD, Borrell A, Microwave-assisted solution synthesis, microwave sintering and magnetic properties of cobalt ferrite, *Journal of The European Ceramic Society* (2010), <https://doi.org/10.1016/j.jeurceramsoc.2017.12.052>

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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 $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, 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 $850\text{--}900^\circ\text{C}$. 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

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