Copper and zinc ferrites obtained by microwave assisted hydrothermal method

J. Maul¹, C. C. L. Santos¹, S. J. G. Lima², D. Keyson¹, A. G. Sousa¹, I. M. G. Santos¹
(¹) LACOM/INCTMN, DQ, Universidade Federal da Paraíba, João Pessoa, PB, Brazil.
(²) LSR, DTM, Universidade Federal da Paraíba, João Pessoa, PB, Brazil

In recent years, interest in transition metal ferrites of the type MFe₂O₄ in nanoscale has greatly increased due to their extensive use in high-density data storage, ferrofluid technology, magnetocaloric refrigeration, magnetic resonance imaging and heterogeneous catalysis [1]. Despite the several techniques used to produced zinc and copper ferrites, in this work the microwave assisted hydrothermal method was used in order to obtain nanometric particles.

The synthesis was done in aqueous solution using iron nitrate Fe(NO₃)₃.9H₂O, copper acetate (CuOOCCH₃)₂.H₂O and zinc acetate (ZnOOCCH₃)₂.2H₂O as precursors, NaOH (5 mol/L) as alkalinizing agent. Stoichimetric amounts of the precursors were used in order to obtain the ZnFe₂O₄, CuFe₂O₄ and Zn₀.₅Cu₀.₅Fe₂O₄. The suspensions were placed in the Teflon reactor and coupled into the microwave oven. Syntheses were done at 150°C for 60 min. Characterizations were done by UV-Vis spectroscopy (UV-vis), X-Ray Diffraction (XRD) and Scanning Electronic Microscopy (SEM).

The XRD patterns confirmed the formation of the spinel ferrites as well monoclinic CuO and Fe₂O₃ as secondary phases formed especially when copper was present. The formation of the secondary phases could be assigned to the difference in the hydrothermal crystallization of zinc, copper and iron oxides. As FeO₆ clusters were the lattice formers if their organization occurred after the other clusters, spinel formation would not be favored leading to secondary phases. The bandgap values were calculated from the UV-Vis data according to Wood and Tauc method. The values obtained were 1.61, 1.23 and 0.88 for ZnFe₂O₄, Zn₀.₅Cu₀.₅Fe₂O₄ and CuFe₂O₄, respectively. The small bandgap values were due to the high amount of metals present in the samples, besides the secondary phases. Different morphologies were obtained as showed by SEM analysis.

Keywords: Hydrothermal, ferrite, microwave.

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e-mail: jeffdandrade@gmail.com Address: Universidade Federal da Paraíba, CCEN, DQ, Cidade universitária, João Pessoa, PB, Brazil, CEP 58059-900.