Polyhedron 29 (2010) 2569–2573

Contents lists available at ScienceDirect

Polyhedron

journal homepage: www.elsevier.com/locate/poly

Effect of composition on structural and magnetic properties of nanocrystalline $Ni_{0.8-x}Zn_{0.2}Mg_xFe_2O_4$ ferrite

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ARTICLE INFO

Article history:
Received 16 February 2010
Accepted 17 April 2010
Available online 27 April 2010

Keywords:
Ferrite
Mg-substitution
Egg-white
XRD
VSM

ABSTRACT

Nanocrystalline magnetic particles of $Ni_{0.8-x}Zn_{0.2}Mg_xFe_2O_4$ ferrites with x lying between 0.0 and 0.8 were synthesized using metal nitrates and freshly extracted egg-white. The synthesized powders were characterized using X-ray diffraction (XRD), Fourier transform infrared (FT-IR) and transmission electron microscopy (TEM). With increasing magnesium concentration, the lattice constant increases while X-ray density decreases. The average crystallite size determined from XRD data using Scherrer formula lie in the range of 35–59 nm. TEM image shows spherically agglomerated particles with average crystallite size agreed well with that obtained from XRD. Magnetic properties measured at room temperature by vibrating sample magnetometer (VSM) reveal a decrease in saturation magnetization up to Mg content of 0.6. In agreement with FT-IR results, the unexpected increase in the magnetization at Mg content of 0.8 can be attributed to the tendency of Mg^{2+} ions to occupy the tetrahedral site. The decrease in the value of coercivity with increasing magnesium content can be explained based on the magneto-crystalline anisotropy.