Magnetic phase-transition dependence on nano-to-micron grain-size microstructural changes of mechanically alloyed and sintered Ni0.6Zn0.4Fe2O4

ABSTRACT

The microstructure evolution in several polycrystalline Ni0.6Zn0.4Fe2O4 samples as a result of a sintering scheme was studied in detail, in parallel with the changes in their magnetic properties. The Ni0.6Zn0.4Fe2O4 toroidal sample was prepared via mechanical alloying and subsequent molding; the sample with nanometer-sized compacted powder was repeatedly sintered from 600 to 1200 °C with an increment of 25 °C. An integrated analysis of phase, microstructural and hysteresis data pointed to existence of three distinct shape-differentiated groups of Bï H hysteresis loops which belong to samples with weak, moderate and strong magnetism (Idza in Mater. Res. Bull. 47:1345ï 1352, 2012), respectively. The real permeability, ε,Nj and loss factor, ε nj increased with grain size which increased due to increase in sintering temperature and these two magnetic properties also seem to belong to three value-differentiated groups corresponding to the same temperature ranges found for the Bï H groupings. These groupings are tentatively explained using Snoekôs Law.

Keyword: Magnetic properties; Microstructure; Magnetic materials; Electron microscopy