Grain growth effects on magnetic properties of Ni0.6Zn0.4Fe2O4 material prepared using mechanically alloyed nanoparticles

ABSTRACT

The effect of grain growth via sintering temperature on some magnetic properties is reported in this research. Ni0.6Zn0.4Fe2O4 nanoparticles were mechanically alloyed for 6 h and the sintering process starting from 600 to 1200 °C with 25 °C increment with only one sample subjected to all sintering scheme. The resulting change in the material was observed after each sintering. Single phase has been formed at 600 °C and above and the intensity peaks increased with sintering temperature as well as crystallinity increment. The morphological studies showed grain size increment as the sintering temperature increased. Moreover, the density increased while the porosity decreased with increasing sintering temperature. The saturation induction, Bs increased with the increased of grain size. On the other hand, the coercivity-vs-grain size plot reveals the critical single-domain-to-multidomain grain size to be about ~400 nm. The initial permeability, μi value was increased with grain size enhancement. The microstructural grain growth, as exposed for the first time by this research, is shown as a process of multiple activation energy barriers.

Keyword: Mechanical alloying (MA); Magnetic properties; Single sample sintering (SSS); Ferrites