Characterization and Structural Analysis of Quasi-Nano Sized Ba-Zn Ferrite Powders Prepared by Self-propagating High Temperature Synthesis and Mechanical Milling

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Self-propagating high temperature synthesis (SHS) reaction is characterized by producing porous microstructure with fine grains and unique chemistry because of non-equilibrium nucleation and growth due to rapid reaction [1]. In this study, nano-sized $Ba_xZn_{1-x}Fe_2O_4$ ferrites especially useful for electro-magnetic insulator were prepared by the SHS reaction and mechanical milling to control particle size and non-stoichiometric number of the products [2]. Characterization of magnetic properties, microstructure observation and structural analysis were carried out by vibrating sample magnetometer, network analyzer, field emission electron microscopy, X-ray diffractometry and neutron diffractometry, respectively. The final products were crystalline with average particle size of less than 250 nm. As the initial composition of barium oxide and magnesium oxide changed from 0.5 to 4.0, the coercive force and residual magnetization and maximum magnetization increased about 34%, 70% and 60% respectively. Neutron diffraction revealed that the change of the magnetic properties and permeability were related to the non-stoichiometries of the ferrite powders.

[1] Y. Choi, Physica B, 327 (2003) 229.
[2] Yajie Chen et al., J. Appl. Phys., 101 (2007) 92.