

Effect of PVP as a capping agent in single reaction synthesis of nanocomposite soft/hard ferrite nanoparticles

ABSTRACT

Nanocomposite magnets consist of soft and hard ferrite phases are known as an exchange spring magnet when they are sufficiently spin exchange coupled. Hard and soft ferrites offer high value of coercivity, H_c and saturation magnetization, M_s respectively. In order to obtain a better permanent magnet, both soft and hard ferrite phases need to be “exchange coupled”. The nanoparticles were prepared by a simple one-pot technique of 80% soft phase and 20% hard phase. This technique involves a single reaction mixture of metal nitrates and aqueous solution of varied amounts of polyvinylpyrrolidone (PVP). The heat treatment applied was at 800 °C for 3 h. The synthesized composites were characterized by Transmission Electron Microscope (TEM), Fourier Transform Infra-red (FT-IR), Energy Dispersive X-Ray (EDX), X-ray diffraction (XRD) and Vibrating sample magnetometer (VSM). The coexistence of two phases, $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$ and $\text{SrFe}_{12}\text{O}_{19}$ were observed by XRD patterns. It also verified by the EDX that no impurities detected. The magnetic properties of nanocomposite ferrites for 0.06 g/ml PVP gives a better properties of H_c 932 G and M_s 39.0 emu/g with average particle size obtained from FESEM was 49.2 nm. The concentration of PVP used gives effect on the magnetic properties of the samples.

Keyword: Exchange coupling; Nanocomposite ferrites; Magnetic properties; Thermal treatment; Single reaction