ABSTRACT

Nickel ferrite nanoparticles are of great interest due to the unique electrical and magnetic properties. They also appeared to have promising biomedical applications such as drug delivery, magnetic resonance imaging enhancement (MRI) and hyperthermia. Nano-nickel ferrite can be synthesized by various methods. Apart from the study of synthesis, the physical properties have been found to follow certain grain-size-dependant-law due to the canted layer in the large ratio of surface.

The aim of this work is to explore the effects of synthetic parameters on the morphology and magnetic properties of Nickel ferrite nanoparticles probes for high-performance magnetic resonance imaging (MRI) and Nuclear Magnetic Resonance (NMR) which are based on the relaxation process of protons when placed in an external magnetic field. Thus, employing solvothermal method and tuning the reaction conditions by using different solvents such as oleylamine, dioctyl ether, diphenyl ether, propylene glycol, benzyl alcohol and H_2O, $NiFe_2O_4$ nanoparticles of different sizes, composition and shapes isolated. In solvothermal synthesis the precursors were put into a closed system (bomb) in the presence of a solvent at 200°C for 24h. $Fe(acac)_3$ and $Ni(acac)_2$ was used as precursors and oleylamine as surfactant. In order to improve the hydrophilic nature of the $NiFe_2O_4$ NPs (Samples D1, D2 and D7), a general preparation for water-soluble nanoparticles was followed with the use of $CH_3(CH_2)_{15}N^+(CH_2)_3Br^-$, (CTAB).

The structure and morphology were characterized by XRD, SEM and TEM while the magnetic properties investigated by VSM. The amount of surfactants coated on the surface of the NPs was quantitatively recorded by thermogravimetric analysis (TGA). IR spectra was used for the characterization of the surface of nanocrystals. Solvothermal synthesis suggested as a simple and cost effective way for high crystallinity Nickel ferrite nanoparticles.