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Microwave Assisted Synthesis and Characterization of Fe_3O_4@SiO_2 Core-Shell Composite Nanoparticles

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Abstract: *In this study, core shell structured Fe_3O_4@SiO_2 nanocomposites have been synthesized by solvothermal method using sodium silicate (Na_2SiO_3), which is more suitable than the conventional silane precursor TEOS (tetraethyl orthosilicate). In the process of surface coating of particle to form a core–shell structure with Fe_3O_4, the Na_2SiO_3 was neutralized with aq. HCl to form silane groups, and the resulting silane groups combined with hydroxyl groups (OH^-) present on the surfaces of the Fe_3O_4 nanoparticles. Then, the Fe_3O_4 nanoparticles and Fe_3O_4@SiO_2 composite nanoparticles were characterized by using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), scanning electron microscope (SEM) and vibrating sample magnetometer (VSM). The infrared spectrum (FT-IR) showed that Fe_3O_4 and SiO_2 molecular functional groups were recorded at the wavenumber of 799 cm-1 with Fe-O-Si bond. Furthermore, Fe-O bond was recorded at the wavenumber of 461 cm-1, Si-O-Si and Si-O bonds were detected at the wavenumbers of 1091 cm-1 and 950 cm-1 respectively. The SEM and PXRD results show that the synthesized nanocomposite has a semispherical structure with an average particle size of 16-20 nm and excellent magnetization properties (27.9 emu/g).*

Keywords: Fe_3O_4, Fe_3O_4@SiO_2, structure, nanocomposite, Microwave, solvothermal

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