Monodisperse Fe_3O_4/Fe@SiO_2 Core/Shell Nanoparticles with Enhanced Magnetic Property

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Core/shell type nanoparticles with an average diameter of 11 nm were synthesized by coating Fe_3O_4 core in an alkyl alcohol (octanol) with amorphous silica shell. The synthesized nanoparticles were calcined under various conditions to produce different types of core/shell particles. The particles were characterized by using various experimental techniques such as transmission electron microscopy(TEM), X-ray diffraction (XRD), energy dispersive X-ray spectrometry (EDS), Fourier transform infrared spectroscopy (FT-IR), thermogravimetric analysis (TGA), X-ray photoelectron spectroscopy (XPS), and vibration sample magnetometer (VSM). To elucidate the relationship monodisperse and stability between surface area and solution, PDI and zetapotential were used. The results suggest that the composition of the three samples (uncalcined, calcined at 200-600℃ for 5 h and 15 h) are Ox- Fe_3O_4@SiO_2, Fe_3O_4/Fe@SiO_2 and γ-Fe_2O_3/Fe@SiO_2, respectively. The saturation magnetization of the particles calcined for 5 h was found to be higher than those of the other particles. It is noted that the formation of metal iron inside the particles during calcination is responsible for the enhanced magnetic property.