多層核殼型聚苯胺/二氧化矽包覆鐵氧化物奈米複材之製備及其電性與磁性之研究

英文摘要

The purpose of this article is to carry out studies on synthesis and characterization of the multilayered polyaniline/silica-coated iron oxide nanocomposites. Two synthesis steps are involved in this work, first is about the preparation of core-shell silica-coated iron oxide nanoparticles. The core-shell structured nanoparticles can be prepared through the well known Stöber process. Second is concerning about the synthesis of multilayered core-shell structure of polyaniline/silica-coated iron oxide nanocomposites by in-situ polymerizing polyaniline on the surface of core-shell structured nanoparticles. As a result, a novel material comprising both leads magnetic and electric conductivity can be obtained. The structure, morphology and properties of samples are characterized by Fourier transform spectrometer (FT-IR), Ultraviolet-Visible spectroscopy (UV-Vis), wide angle X-ray diffraction (WAXD), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), microhmeter, and superconductor quantum interference device (SQUID). The results showed that, as the weight ratio of γ-Fe2O3/TEOS is less than 0.55, the silica-coated maghemite (SiO2/γ-Fe2O3) particles with well-defined a core-shell structure can be conveniently prepared. Furthermore, the thickness of silica coating on the surface of γ-Fe2O3 nanoparticles increases gradually with increasing the TEOS content. For the room-temperature SQUID analysis, the magnetic properties of SiO2/γ-Fe2O3 nanocomposites are mainly dominated by γ-Fe2O3, and all SiO2/γ-Fe2O3 nanocomposites show superparamagnetic behavior. In addition, the saturation magnetization of the synthesized SiO2/γ-Fe2O3 nanocomposites decreases dramatically upon the increase of silica layer thickness. The magnetic properties and

superparamagnetic behavior of multilayered core-shell PANI/SiO2/γ-Fe2O3 nanocomposites are found to be the same as the described above. As for microhmeter measurements, revealing the conductivity of nanocomposites increase with increasing the thickness of silica layer. As the amount of SiO2/γ-Fe2O3 nanocomposites is decreased, the doping level and the conductivity of multilayered core-shell PANI/SiO2/γ-Fe2O3 nanocomposites are significantly increased.