聚苯胺/磁赤鐵礦奈米複材之製備及其電磁特性之研究

英文摘要

The purpose of this study is to carry out researches on the synthesis of the polyaniline/r-Fe2O3 nanocomposites by using the reverse micelle polymerization. The effects of re-doping time, surfactant concentration and ferric chloride content on the electromagnetic properties of polyaniline/r-Fe2O3 nanocomposites were investigated by Fourier transform spectrometer (FT-IR), Ultraviolet-Visible spectroscopy (UV-Vis), X-ray photoelectron spectroscopy (XPS), wide angle X-ray diffraction diffractometer (WAXD), impedance analyzer, microhmeter, and superconductor quantum interference device (SQUID). The nanostructure of the polyaniline/r-Fe2O3 nanocomposites was characterized by transmission electron microscopy (TEM). It is found that the dispersed r-Fe2O3 phase is roughly distributed in the polyaniline matrix. Results showed that, in the presence of r-Fe2O3, the growth rate of quinoid ring is markedly retarded, no significant relationship between the growth rate of quinoid ring and r-Fe2O3 contents is observed. The crystalline and doping level of polyaniline in the nanocomposites increases with re-doping time, the conductivity and dielectric properties (ie., permittivity and loss factor) of nanocomposites are hence increased, the ionic polarization relaxation time become shorter from 1.71x10-9 to 7.48x10-10 sec. The particle size and r-Fe2O3 content in the nanocomposites decrease with re-doping time due to the reduction effect from the protonic acid that is doped on to polyaniline. For the room-temperature SQUID analysis, the magnetic properties of nanocomposites are mainly dominated by r-Fe2O3, a significantly superparamagnetic behavior is observed, suggesting the thermal fluctuations contribution to the magnetic moment. The saturated magnetization and specific saturated magnetization decrease with decreasing r-Fe2O3

particle size and its content. At various ferric chloride and surfactant compositions, the composition of r-Fe2O3 in nanocomposites increase with ferric chloride content in the reverse micelle reaction, whereas it decreases with surfactant concentration, and a typically superparamagnetic behavior is also observed. Both saturated magnetization and specific saturated magnetization are found to increase with the particle size and content of r-Fe2O3, respectively. Based on the same re-doping time, the doping level of the polynailine in nanocomposites turns out to be independent of surfactant concentration and input ferric chloride content and the crystalline is markedly improved resulting in the loss in the dielectric strength and conductivity. The relaxation time of the ionic polarization is prolonged at the same time.