

Synthesis of carbon encapsulated iron nanoparticles for applications in biomedicine

M. Reza Sanaee, N. Aguilo-Aguayo, and E. Bertran

FEMAN Group, Institute of Nanoscience and Nanotechnology, Department of Applied Physics and Optics, University of Barcelona, Spain

Magnetic nanoparticles are being of great interest because of their unique properties especially in drug delivery, magnetic resonance imaging, hyperthermia and cell separation. The ultimate goal of magnetically controlled drug delivery and drug therapy is to selectively delivering drug molecules to the diseased site without a concurrent increase in its level in healthy tissues. The objective of this study is to synthesize carbon encapsulated iron nanoparticles (CEINPs) as suitable nanocarriers. Although to date most studies have focused on the development of polymer or silica protective coatings, recently CEINPs are receiving more attention, because carbon-based materials have many advantages over polymer or silica, such as high chemical and thermal stability, as well as biocompatibility of carbon-based materials. A modified arc discharge reactor was utilized to synthesise CEINPs at near atmospheric pressure (5-8-104 Pa). The morphologies and composition mapping features of CEINPs were investigated by electron microscopy (HTEM and SEM), energy dispersive X-ray analysis (EDX) and electron energy loss spectroscopy (EELS). SEM and HTEM images illustrate Core@Shell nanostructure and spherical shape of particles. Only iron peak was observed from EELS and EDX analysis and no trace of oxygen or other impurities were found. Thus, all iron particles were well protected by carbon shells. In addition, detailed information of carbon shell crystallinity was examined by Raman spectroscopy. The iron core magnetic properties were studied by superconducting quantum interference device and their superparamagnetic behavior was investigated at body temperature. It is concluded that the morphological and magnetic properties of obtained CEINPs meet the requirements of a suitable candidate for biomedical applications.

Biography

M. Reza Sanaee has completed his master program in Nanoscience and Nanotechnology with "Excellent Average Grade Point" distinguished by the University of Barcelona, Spain. Since 2011 he is a Ph.D. Student at the same university and is a member of FEMAN Group at the institute of Nanoscience and Nanotechnology, Dept. of Applied Physics and Optics. During the recent one-two years, he has been succeeded in developing and presenting seven manuscripts at international level.

m-reza@sanaee.com