Journal of Nanoparticle Research 2015 vol.17 N2

Blue shift in optical absorption, magnetism and light-induced superparamagnetism in γ-Fe2O3 nanoparticles formed in dendrimer

Domracheva N., Vorobeva V., Gruzdev M., Pyataev A.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2015, Springer Science+Business Media Dordrecht. Abstract: We are presenting the investigation of the optical, magnetic, and photoinduced superparamagnetic properties of single-domain γ-Fe2O3 nanoparticles (NPs) with diameters of about 2.5 nm formed in second-generation poly(propylene imine) dendrimer. The optical absorption studies indicated direct allowed transition with the band gap (4.5 eV), which is blue shift with respect to the value of the bulk material. Low-temperature blocking of the NPs magnetic moments at 18 K is determined by SQUID measurements. The influence of pulsed laser irradiation on the superparamagnetic properties of γ-Fe2O3 NPs was studied by EPR spectroscopy. It has been shown that irradiation of the sample held in vacuo and cooled in zero magnetic field to 6.9 K leads to the appearance of a new EPR signal, which decays immediately after the irradiation is stopped. The appearance and disappearance of this new signal can be repeated many times at 6.9 K when we turn on/turn off the laser. We suppose that the generation of conduction band electrons by irradiation into the band gap of the γ-Fe2O3 changes the superparamagnetic properties of NPs. Graphical Abstract: [Figure not available: see fulltext.]Features of the behavior of single-domain γ-Fe2O3 nanoparticles formed in dendrimer were found by UV-Vis and EPR spectroscopy: “blue” shift in optical absorption, a significant increase in the band gap width and variation of superparamagnetic properties under light irradiation.

http://dx.doi.org/10.1007/s11051-015-2890-z

Keywords

Dendrimers, EPR spectroscopy, Nanoparticles, Semiconductor, Superparamagnetism, UV/Vis spectroscopy