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Theoretical Calculation of Optical and Magneto Optical Properties of Magnetite Nanorods

The optical and magneto-optical called Faraday rotation of composites containing isolated Fe3O4 (magnetite) nanorod particles are presented in the wavelength range from 300 −700 nm. The results were obtained by using the discrete dipole approximation (DDA) method. The composite materials are constructed by combining Fe3O4 nanorod particles and the material with fixed dielectric constant of 2.25. The Fe3O4 nanorod of different aspect ratio (AR), varied from 3 to 7, was used to embed in the host material. The influence of the orientation of Fe3O4 nanorod comparing with the incident light and number particles on the Faraday rotation spectrum were also presented. The absorption cross-section spectra of Fe3O4 nanorods were able to be observed only when the main axis was aligned parallel to the polarization direction and perpendicular with the direction propagation of excited light. All samples were found that the Faraday rotation spectrum show two distinct regions of negative rotation at shorter wavelength and positive rotation at both shorter and longer wavelengths. Moreover, qualitative results of Faraday rotation spectra suggest that the shifts in spectral peak position depend on aspect ratio, the relative orientation of the nanorod in the incident electromagnetic field and number of particles.

Keywords: faraday rotation; magnetite nanorod; Discrete Dipole approximation

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