Faraday effect of colloidal gold spherical nanoparticles with dimensions between 5 and 200 nm

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Au-metallic nanoparticles (AuNPs) are one of the most investigated nanomaterials. Despite being non-magnetic AuNPs were found to display sizable magnetooptical (MO) properties when they are confined in the nanostructure. In the last two decades, the MO properties of colloidal AuNPs have been mainly described by magnetic circular dichroism (MCD) spectroscopy. An extensive set of MCD spectra was obtained for AuNPs with dimensions (D) of 3 nm to 25 nm. Despite the fact that MCD spectra are closely connected to MORD (dispersion of Faraday effect (FE)) through Kramers-Kronig (KK) relationships, only one paper [1] was directly devoted to FE (D = 17 nm) and its theoretical modelling. The FE is widely employed in many magnetooptical devices and in recent years has been extensively researched for all-optical magnetization reversal by inverse FE (IFE). Recently, the FE and IFE of 100 nm colloidal AuNPs have been described [2]. The paper presents room-temperature FE spectra at 280-650 nm for colloidal AuNPs in aqueous citrate buffer with particle D equal to 5, 20, 40, 60, 100 and 200 nm and exhibiting the localized surface plasmon resonance (LSPR) between 520 and 575 nm. In practice the FE have low magnitude but the obtained results show systematic changes related to LSPR position and are in good relation with the results of ref. [1], but they are about 2 orders smaller than those describing FE in a static magnetic field presented in ref. [2]. In addition, the KK analysis performed for our MORD spectra allowed for further discussion and comparison with literature results. Modelling of the obtained MORD spectra for the plasmonic resonances using the Maxwell-Garnett theory will also be presented.

References:

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