Characterization of $SbPO_4$-ZnO-PbO glass system containing $CdFe_2O_4@SiO_2$ nanoparticles

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The study of glass or glass ceramics containing magnetic nanoparticles have attracted the attention of many researchers. The research field using glass matrices containing magnetic nanoparticles is called spin-photonics, where photons can be used to standardize magnetic media and to study the fundamental properties of the interaction of light with magnetic materials.[1,2] This work aimed to prepare and to characterize a glass in the system $SbPO_4$-ZnO-PbO in proportion 60-10-30% (mol), respectively, containing $CdFe_2O_4@SiO_2$ magnetic nanoparticles. Cadmium ferrite was prepared by the coprecipitation method. The nanoparticles were coated with an insulating layer, forming a structure of the type core@shell, in order to prevent the reaction of oxygen with the surface atoms and to improve their dispersion in the matrix. The average size of the nanoparticles is 3,92 nm. Five vitreous samples were prepared, one without nanoparticles, and four others containing 0,1, 0,5, 1 and 2,5% of nanoparticles. The glass samples were prepared by melting-quenching method and subsequent annealing below the glass transition temperature (Tg) for 2 h and cooled to room temperature. The criteria used for choosing the matrix were high thermal stability, ease of preparation and high RI (1.88). Transmission electron microscopy (TEM) revealed in the Figure 1A) the presence of nanoparticles dispersed through the glass, in 1B) can observe the crystal planes of the $CdFe_2O_4$ proving that there was nanoparticles in the glass.

Figure 1- Transmission electron microscopy of glass containing 2,5% of $CdFe_2O_4@SiO_2$.

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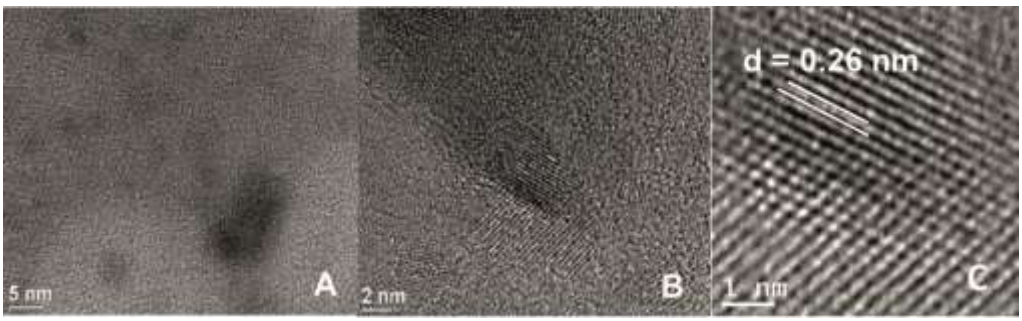

The interplanar spacing calculated from FFT (Fast Fourie trasnformer) to d_{311} is 0,26 nm the value found in the literature is 0,259 nm(Figure 1C). The materials obtained also were studied by Photoluminescence Spectroscopy, Raman Spectroscopy, UV-Vis Spectrospy and thermal analysis.

1. Bigot J. Y., et al. ; Nature Phys. **2015**, 5, 515.
2. Boeglin, C., et al. ; Nature. **2010**, 465, 458.

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