Sb_2O_3-$SbPO_4$ glass containing Cobalt-Platinum magnetic nanoparticles.

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Introduction

Glasses are versatile materials which allow the dissolution and/or dispersion of other chemical elements in their composition as rare earth ions, metallic and magnetic nanoparticles.[1] 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. Monometallic elements can have their magnetic and chemical properties improved by forming alloys offer many advantages such as increased magnetic susceptibility, high coercivity and high magnetic anisotropy. The CoPt alloy is a candidate for high density magnetic recording media due to their high magnetic anisotropy and good chemical stability. This work aimed to prepare a glass in the system Sb_2O_3-$SbPO_4$ containing Cobalt-Platinum magnetic nanoparticles and analyze their properties.

Results and Discussion

The nanoparticles were synthesized by the reduction of the metal precursors method (Co and Pt) in solution using high-boiling solvent and reductant. 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 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. Two vitreous samples were prepared with the proportion of 60% Sb_2O_3 - 40% $SbPO_4$ (mol) and in one of the samples was added 1% of CoPt magnetic nanoparticles. Figure 1 shows the absorption spectrum for matrices with and without nanoparticles. The absorption bands at 542 nm, 587 nm and 630 nm can be assigned to Co^{2+} ions dissolved in the matrix, which give the glass a blue color even in concentrations as low as 0.005%.
By transmission electron microscopy the Figure 2a revealed the presence of nanoparticles dispersed through the glass, in 2b we can clearly observe the crystal planes of the Cobalt-Platinum proving that there was dispersion of magnetic nanoparticles in the glass. The interplanar spacing calculated from FFT (Fast Fourier transformer) to d_{111} is 2.25 Å indicating that the nanoparticles are an alloy.[5]

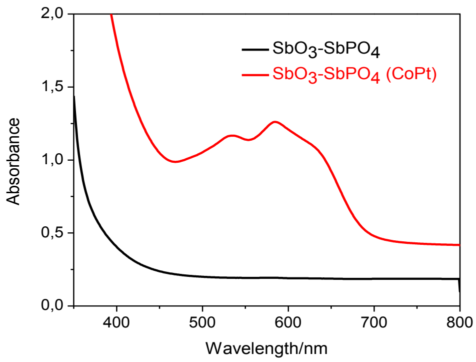

Figure 1. Absorption Spectrum data for SbO_3-$SbPO_4$ glasses, without and with CoPt.

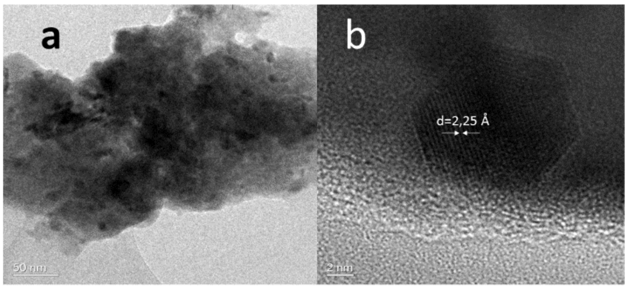

Figure 2. Transmission electron microscopy of glass containing CoPt a) nanoparticles dispersed through the glass and b) crystal planes of the Cobalt-Platinum

Conclusions

The Sb_2O_3-$SbPO_4$ glass matrix proved to be an efficient host for dispersion of magnetic nanoparticles CoPt. Despite the presence of Co^{2+} ions dissolved in the matrix verified by the absorption spectrum can be observed by the analysis of transmission electron microscopy that the incorporation of magnetic nanoparticles occurred satisfactorily.

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