

Magnetization curves for interaction between PdCo PMA thin film with CoFe_2O_4 nps in different quantities

AU-13. Room temperature ferromagnetic behaviour in Dy^{3+} doped dilute magnetic semiconductor nanoparticles. S. Jindal¹ and P. Sharma²
¹. School of Physics and Material Science, Thapar Institute of Engineering and Technology, Patiala, India; ². School of Physics and Material Science, Thapar Institute of Engineering and Technology, Patiala, India

II-VI dilute magnetic semiconductors are promising material for application in electronics. Currently a great deal of attention is being focused on adding spin degree-of-freedom into semiconductor to create a new area of solid-state electronics, called spintronics [1]. Such materials need to be good semiconductors for easy integration in typical integrated circuits with high sensitivity to the spin orientation. The major material challenge is to magnetize and stabilize semiconductors with room temperature ferromagnetic ordering without significantly affecting the physical properties of semiconductors. Cadmium sulfide (CdS) is one of the promising II-VI semiconductor due to its inherent property of direct band gap of 2.42 eV and in green spectral range [2, 3]. Rare-earth (RE) elements play an important role in many functional materials and exhibit interesting magnetic and optoelectronic properties. Due to their highly localized 4f electrons, the direct f-f interactions between the neighbouring rare-earth atoms are very weak. This produces larger magnetic moments in 4f REs than 3d transition metals. Most of the earlier works on dilute magnetic semiconductor (DMS) were focused on TM doped ZnS, CdS. Since REs have higher magnetic moment than TMs, we expect to achieve higher magnetization with a few percentages of RE doping. In the present work, $\text{Cd}_{1-x}\text{Dy}_x\text{S}$ ($x = 0.00, 0.05, 0.10$ and 0.15) nanoparticles were synthesized by hydrothermal technique. The room temperature (RT) magnetic hysteresis loops of synthesized nanoparticles are shown in Fig.1. The magnetization increases upto $x = 0.10$, and then decreases. This increase in magnetization may due to the formation of various defects or vacancies with doping [4]. Fig.2 shows UV- visible absorption spectra with Tauc's plot of $\text{Cd}_{1-x}\text{Dy}_x\text{S}$ nanoparticles. The optical bandgap (E_g) enhances from 2.43 eV ($x = 0.00$) to 2.55 eV for $x = 0.10$. Further, for higher doping content E_g decreases. This blue shift in optical bandgap with doping can be attributed to the quantum confinement effect.

[1] C. Liu, F. Yun, H. Morkoc, J. Mater. Sci. Mater. Electron. 16, 555 (2005). [2] S. Shirakata, K. Ohkubo, Y. Ishii, T. Nakada, Sol. Energy Mat. Sol. Cells 93, 988 (2009). [3] C.B. Murray, D.J. Norris, M.G. Bawendi, J. Am. Chem. Soc. 115, 8706 (1993). [4] J. P. Tang, L. Wang, H. J. Luoc, W. Z. Xiao, Phys.Lett. A 377, 572 (2013).

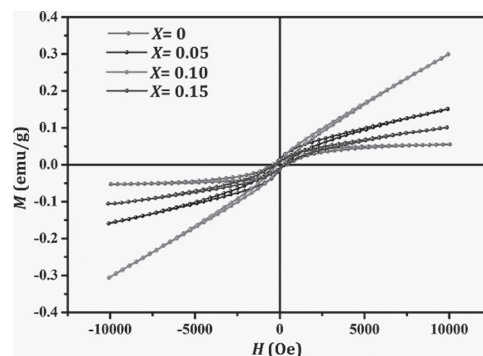


Fig. 1 M - H curves of $\text{Cd}_{1-x}\text{Dy}_x\text{S}$ nanoparticles.

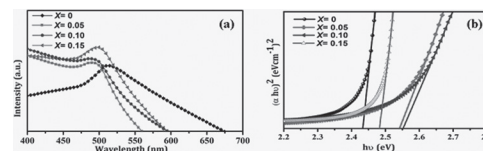


Fig 2 (a) UV-visible absorption spectra (b) Tauc's plot of $\text{Cd}_{1-x}\text{Dy}_x\text{S}$ nanoparticles.

AU-14. RE-doped Fe_3O_4 (RE = Eu, Gd, Er) nanoparticles for nanothermometry. E. Correa^{1,2}, B. Bosch-Santos^{3,2}, T. Sales², G. Cabrera-Pasca⁴, B.S. Corrêa², O.F. Neto², A.W. Carbonari², V. Oleshko¹ and C. Dennis¹
¹. Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, United States; ². Nuclear and Energy Research Institute, Sao Paulo, Brazil; ³. NIST Center for Neutron Research, National Institute of Standards and Technology, Gaithersburg, MD, United States; ⁴. Federal University of Para, Abaetetuba, Brazil

Temperature affects every physical system, chemical reaction, and biological process. A new method, magnetic nanothermometry, is being explored to measure temperature throughout a volume. This method uses large changes in magnetization as function of temperature, which cannot be obtained with current magnetic nano-objects (MNO). To get a large magnetization change we have examined the magnetic properties of RE-doped Fe_3O_4 (RE = Eu, Gd, Er) MNO. Samples were synthesized by co-precipitation. For the doped material, RE^{+3} were chosen in order to replace the Fe^{+3} in the $(\text{Fe}^{2+})(\text{Fe}^{+3})_2\text{O}_4$ structure. Structural characterization was performed by X-ray diffraction and transmission electron microscopy. Hyperfine interaction parameters as a function of temperature (300 K to 873 K) were obtained by perturbed angular g-g correlation (PAC) spectroscopy using $^{111}\text{In}(^{111}\text{Cd})$ as probe nuclei. To fit the PAC spectra, the ^{111}Cd probes were considered to occupy three sites: tetrahedral, octahedral, and a third site where the probes are located at the nanoparticle surface [1]. The hyperfine magnetic field B_{hf} was calculated using the Larmor equation, and its behavior as a function of temperature follows a Brillouin-type transition. For example, the Curie temperature (T_C) obtained for 5% Er-doped was approx. 846 K (FIG. 1), which is higher than the expected T_C for pure Fe_3O_4 (approx. 722 K) [2]. Magnetization as a function of temperature shows a 70 % change in magnetization around 100 K for Er-doped Fe_3O_4 (FIG.2), which is an improvement in temperature on pure Fe_3O_4 (below 50 K) [3]. Current work is focused on correlating the temperature range in which the magnetization change occurs and determining if it depends on the dopant element.

1. E.L. Correa, B. Bosch-Santos, R.S. Freitas, M.P.A. Potiens, M. Saiki, A. W. Carbonari, *Nanotechnology*, 29 (2018) 205704. 2. I. T. Matos, B. Bosch-Santos, G. A. Cabrera-Pasca, A. W. Carbonari, *J. Appl. Phys.* 117 (2015) 17D511. 3. Y. Liu, Y. Wang, S. Zhou, S. Lou, L. Yuan, T. Gao, X. Wu, X. Shi, K. Wang, *ACS Appl. Mater. Interfaces*, 4 (2012) 4913.