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R. Vijayakumar, R. Nagaraj, P. Suthanthirakumar, P. Karthikeyan, K. Marimuthu

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Silver (Ag) nanoparticles enhanced luminescence properties of Dy^{3+} ions in borotellurite glasses for white light applications

R.Vijayakumar[1,*], R.Nagaraj[2], P.Suthanthirakumar[3], P.Karthikeyan[3], K. Marimuthu[3]

[1]Key Lab of Advanced Transducers and Intelligent Control System, Ministry of Education and Shanxi Province, College of Physics and Optoelectronics, Taiyuan University of Technology, Taiyuan 030024, P. R. China

[2]SSN Research centre, SSN College of Engineering, kalavakkam-603 110, Tamil Nadu, India

[3]Department of Physics, Gandhigram Rural University, Gandhigram-624 302, Tamil Nadu, India

*Corresponding author, E-mail address: rvrvijayakumar1@yahoo.co.in

Abstract

In the present work, the structural and optical properties of borotellurite glasses co-doped with Dy^{3+} ions and Ag nanoparticles were investigated. From HR-TEM analysis, the average Ag nanoparticle diameter was calculated as 13.7±1 nm. The negative sign of the bonding parameter explored the ionic nature of metal-ligand (Dy–O) bonds. The emission spectra exhibited three emission bands in blue, yellow and red regions corresponding to $^4F_{9/2}\rightarrow{}^6H_{15/2}$, $^4F_{9/2}\rightarrow{}^6H_{13/2}$ and $^4F_{9/2}\rightarrow{}^6H_{11/2}$ transitions, respectively. The Yellow/Blue (Y/B) ratio of optimal BTD0.5A glass was found to be 1.881 and this low Y/B ratio indicated the fact that Dy^{3+} ions were located in higher symmetrical ligand environment. The CCT values are found to vary from 3717 to 3800 K and hence the present glasses may emit cool white light when excited with UV lamp. The radiative parameters were calculated for all the emission transitions by using JO theory. The decay curves are found to show non-exponential behavior for all the studied glasses. The obtained results were discussed in detail and compared with similar reported glasses.

Keywords: Photoluminescence, Ag nanoparticles, Judd-Ofelt theory, radiative properties, HR-TEM, CIE 1931 diagram