Role of Sm^{3+} on Mn Nanoparticles Embedded Zinc Tellurite Glasses Absorption and Luminescence Characteristic

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ABSTRACT

Enhancing the optical performance of rare earth doped binary inorganic glasses is an ever-demanding quest. Samarium (Sm^{3+}) doped zinc tellurite glasses containing Manganese (Mn) nanoparticles (NPs) with composition $(59\text{-}x)TeO_2\text{-}20ZnCl_2\text{-}10ZnO\text{-}10Li_2O\text{-}1Sm_2O_3\text{-}(x)Mn_3O_4$, where x = 0 to 0.06 mol% are prepared by melt quenching technique. The role played by Mn NPs in enhancing the optical behaviors are analyzed and discussed. The XRD patterns confirm the amorphous nature of the glass. The UV-Vis-NIR spectra reveal seven prominent absorption bands of Sm^{3+} ions. The photoluminescence spectra display four peaks corresponding to $^4G_{5/2}\rightarrow{}^6H_{5/2}$, $^4G_{5/2}\rightarrow{}^6H_{7/2}$, $^4G_{5/2}\rightarrow{}^6H_{9/2}$ and $^4G_{5/2}\rightarrow{}^6H_{11/2}$ transitions. An enhancement in the luminescence intensity is observed up to 0.05 mol% concentration of NPs and the intensity quenches beyond it. The enhancement is attributed to local electric field effect of NPs in the proximity of Sm^{3+} ion. Our results on improved optical response via precise control of NPs contents may be useful for the development of solid state lasers and amplifiers.

KEYWORDS: Zinc-tellurite glass, photoluminescence, absorption, nanoparticles

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