

Effect of noble metal nanoparticles on the Luminescence of rare earth ions in phosphor

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The effective extraction of light from the phosphor for different Applications has become a major issue of study. Some significant improvements in light output have been made by modifying the excitation by using co-doping by different activators such as rare-earth (RE) and transition metal. However, rare earth (RE) ions have a small cross section due to parity forbidden f-f transitions, which mean that they cannot be efficiently excited directly by long wavelength ultraviolet (UV)

light longer than 300 nm. Researchers have used different approaches, particularly exciting the strong f-d transitions of RE at shorter wavelengths or employing energy transfer from a sensitizer such as Ce, to enhance the excitation efficiency of RE ions. In this work, Ag NPs have been incorporated together with RE ions in different hosts with different preparation techniques, with the aim to enhance the f-f absorption of RE ions (Figure 1) due to the strong electric field associated with the localized surface plasmon resonance (LSPR) of the Ag NPs (Figure 2).



Figure 1: Luminescence spectra of silica samples doped with 5 mol% Tb and 1 mol% concentrations of silver (a) excitation ($\lambda_{em} = 544$ nm) and (b) emission ($\lambda_{exc} = 325$ nm), after annealing at 500°C for 2 h.



Figure 2: (a) SEM and (b) TEM results for Ag NPs in Silica synthesized by Sol-gel