

EFFECT OF DOPANT CONCENTRATION ON THE PERSISTENT LUMINESCENCE OF Tb³⁺ DOPED CADMIUM SILICATE

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Persistent luminescence materials continue emitting light after ceasing the irradiation. The most studied persistent luminescence phosphors are those containing Eu²⁺ ion as the emitting center. In some systems, persistent luminescence is observed to originate from trivalent rare earth ions (R³⁺), however. The R³⁺ concentrations may affect both the persistent emission intensity and duration. In this work, the CdSiO₃:Tb³⁺ phosphors were prepared with a solid state reaction at 950 °C with the Tb³⁺ concentration ranging from 0.1 to 10 mole-% of the Cd amount. The X-ray powder diffraction patterns indicated that the main component is the cadmium metasilicate (CdSiO₃) with some cadmium orthosilicate (Cd₂SiO₄) phase as an impurity.

The excitation spectra showed the dopant concentration affecting both the inter and intraconfigurational transitions (Fig. 1). The intensity of the band at 300 nm, assigned to the 4f⁸→4f⁷5d¹ transition is the highest with 1 % Tb³⁺ doping, presenting a concentration quenching for higher doping levels. The intensity of the intraconfigurational 4f transitions (350-376 nm) increases along with the dopant concentration. This behavior leads to different emission spectra (Fig. 2) depending on the excitation wavelength, either to the host, 4f⁸→4f⁷5d¹ or 4f⁸-4f⁸ transitions. The green persistent luminescence arises from the ⁵D₄→⁷F_{5,6} transitions of Tb³⁺. The persistent luminescence was the longest with the 1 % Tb³⁺ concentration. The results show that the dopant concentration plays a fundamental role on the photo- and persistent luminescence properties of the CdSiO₃:Tb³⁺ phosphor.

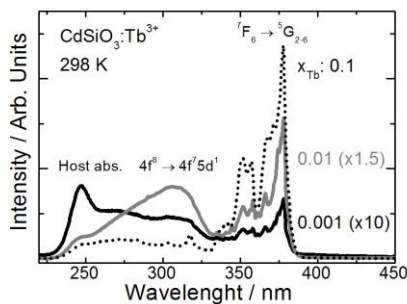


Fig. 1 Excitation spectra of CdSiO₃:Tb³⁺; emission at 544 nm.

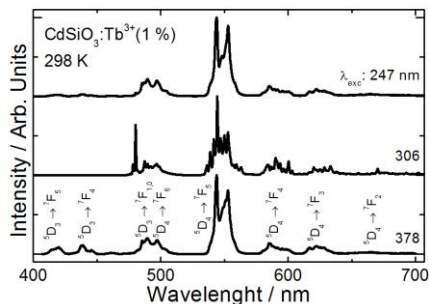


Fig. 2 Emission spectra of CdSiO₃:Tb³⁺ (1 %); excitation at 247, 306 and 378 nm.