

Optical and dielectric studies for Tb³⁺/Sm³⁺ co-doped borate glasses for solid-state lighting applications

ABSTRACT

Singly doped Tb³⁺ and Sm³⁺ ions along with co-doped Tb³⁺/Sm³⁺ borate glasses have been fabricated by melt quenching technique. Both TGA and DSC curves were measured for exploration of thermal properties. Among all Tb³⁺/Sm³⁺ co-doped glasses, the (Tb_{0.5}-Sm_{0.5}) glass shows the highest emission intensity with respect to others. A total of five emission bands where two are from Tb³⁺ transitions corresponding to 488 nm (blue) (5D₄ → 7F₆) and 543 nm (green) (5D₄ → 7F₅) are found. Three emission bands from Sm³⁺ at 563 nm (green), 599 nm (orange-red) and 645 nm (red) according to 4G_{5/2} → 6H_{5/2}, 4G_{5/2} → 6H_{7/2}, and 4G_{5/2} → 6H_{9/2} electronic transitions are identified. The calculated CIE chromaticity (x,y) coordinates for singly doped Tb³⁺ (Tb_{0.5}) green emission, singly doped Sm³⁺ (Sm_{0.5}) orange-red emission, and co-doped Tb³⁺/Sm³⁺ (Tb_{0.5}-Sm_{0.5}) yellow emission are (0.343, 0.584), (0.607, 0.389), and (0.438, 0.515), respectively, following the CIE 1931 chromaticity diagram. Further, dielectric features were studied for the Tb³⁺/Sm³⁺co-doped glass (Tb_{0.5}-Sm_{0.5}) in terms of dielectric constant, dielectric loss and AC conductivity with the increasing of frequency and temperature.

Keyword: Borate glass; Thermal analysis; Luminescence property; Dielectric property