Abstract

The possibility of using Sm^{3+}- and Dy^{3+}-doped Gd_2O_3 nanopowders as thermographic phosphor materials was studied. Both samples were synthesized by a combustion method. The crystalline structure of synthesized samples was confirmed by x-ray diffraction measurements. Photoluminescence measurements were recorded in the temperature range from 298 to 773 K. The photoluminescence spectrum of Sm^{3+} showed peaks that originate from $^4G_{5/2} \rightarrow {}^6H_J$ transitions, while in the case of Dy^{3+} $^4F_{7/2} \rightarrow {}^6H_J$ transitions were observed. The fluorescence intensity ratio of the prepared nanomaterials was studied as a function of temperature using the $^4G_{5/2} \rightarrow {}^6H_{5/2}$ and $^4G_{5/2} \rightarrow {}^6H_{7/2}$ transitions of Sm^{3+} ions and the $^4F_{7/2} \rightarrow {}^6H_{13/2}$ and $^4F_{7/2} \rightarrow {}^6H_{15/2}$ transitions of Dy^{3+} ions. Both doped Gd_2O_3 samples proved to have good potential for the development of thermographic phosphors. The maximum sensitivity was approximately 1.744×10^{-3} K^{-1} for the sample with 1 mol% Sm^{3+} at 701 K and 2.48×10^{-3} K^{-1} for the sample with 1 mol% Dy^{3+} at 773 K. The lifetime measurements were recorded in the same temperature region for the 606 and 572 nm lines of samarium and dysprosium, respectively. The lifetime at room temperature was found to be about 0.395 ms for Sm^{3+} and 0.123 ms for Dy^{3+} and it decreased as the temperature increased