Scintillation characteristics of borosilicate glass doped with Tb3+/ Ce3+ ions

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Abstract

The oxide glass doped with rare-earth ions (REI) are widely used as active media in optoelectronics, scintillation materials, UV-Vis radiation converters. Simplicity of synthesis of glassy materials, the ability to manufacture optical elements of any shape and size, relatively low cost, possibility to incorporate impurities, opportunity to change the host composition and high optical homogeneity makes them an alternative to single crystals.
The development of new materials with specific optical properties requires an understanding of the luminescence mechanisms in different systems, processes for electronic excitations between the luminescence centers and the glass host, the interaction of activated ions between them. All of this purposes directed to improving of luminescent characteristics and light yield for different applications.

In this work, we developed Tb3+/Ce3+ doped Al2O3-B2O3-SiO2-BaCO3-Gd2O3-P2O5 scintillating glasses by a melt quenching method. The luminescent properties were studied by the transmittance, photoluminescence, cathodoluminescence spectra and decay curves.

In nanosecond time range the strong "blue" emission (4f-5d transition) due to radiation of Ce3+ ions under selective and non-selective excitation was recorded. The results are shown that the Ce3+ ions sensitized the luminescence of the Tb3+ ions by energy transfer process from Ce3+ to Tb3+ ions under UV and electron beam excitation.

The luminescence in "blue-green" region spectra for all investigated samples is occurred. The radiative transitions occur from the excited states 5D3, 5D4 to the ground state 7Fj in terbium ions.
The luminescence decay kinetics of glass excited by electron beams and pulse laser excitation was studied in detail. The mechanism of energy transfer between Tb3+ and Ce3+ ions are discussed.

Keywords: scintillating glass, luminescence decay kinetics, electron excitation

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