

LUMINESCENCE CHARACTERISTICS OF CaSO₄:Tb,M (M=Na,K,Rb) PHOSPHORS

Irina Kudryavtseva¹, Aleksei Krasnikov¹, Evgeni Shablonin¹

¹*Institute of Physics, University of Tartu, Estonia*

e-mail of presenting author: irina.kudryavtseva@ut.ee

Wide-gap materials demonstrate various fascinating properties and are used in different technological applications. In the present study, the investigation of complex luminescence terbium centres as well as the analysis of technological features of the synthesis of small-grained wide-gap CaSO₄:Tb³⁺ anhydrite phosphors containing 1% of Tb³⁺ and some amount of additional impurity ions (Na⁺, K⁺, Rb⁺, F⁻, Cl⁻, Br⁻) have been continued (see also [1, 2] and references therein) using the methods of optical and thermoactivation spectroscopy. A set of CaSO₄:Tb³⁺ micrograined phosphors was synthesized by the solid-state reaction route in an extra dry air atmosphere at 750°C. Of particular interest was a contribution of calcium ions into formation of complex luminescence centres. Ca causes efficient dynamic hybridization of electronic states and influence on the formation of terbium and near-terbium electronic excitations (see also [2]).

The excitation spectra of Tb³⁺-centre emission have been measured in the VUV spectral range at 80 or 300 K. The excitation band related to the lowest *f-d* transition of Tb³⁺ ions at ~5.9 eV in CaSO₄ undergoes broadening toward the long-wavelength side, when the radius of a charge compensator increases (K⁺ → Rb⁺). The band at 8–9 eV ascribed to the excitation of oxyanions has a different shape in CaSO₄:Tb,K and CaSO₄:Tb,Rb. By changing the components of phosphorus synthesis, we obtain green (⁵D₄ → ⁷F_J transitions) and blue (⁵D₃ → ⁷F_J transitions) luminescence of terbium ions in different ratios to each other. Thermally stimulated luminescence (80–700 K) has been analyzed for a set of anhydrite phosphors previously irradiated by X-rays or VUV photons, selectively forming different intrinsic electronic excitations, at 80 and 300 K. In the TSL curves, the intensity of high-temperature TSL peaks increases with increasing radius of the charge compensator (K⁺ → Rb⁺), which allows us to consider CaSO₄:Tb,Rb as a dosimeter.

References

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