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Luminescent glass-ceramics and cellulose-oxide composites based on K2Eu(PO4)(WO4) red phosphor

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Elaboration of effective red phosphor for lighting applications remains one of the main directions in material science nowadays. Such phosphor should absorb part of ultraviolet or blue emission of the base chip and transform obtained energy into red light. Oxide compounds doped with rare-earth ions, namely Eu³⁺ ions, are among the candidates for such phosphors. It was found recently that K₂Eu(PO₄)(WO₄) reveals intensive red luminescence under excitation at 380, 393, and 466 nm. Moreover, the studies showed that this material exhibit a quantum yield close to unity for abovementioned excitations. It is worth to note that covering of semiconductor chip with phosphor layer can be performed by introducing of the luminescent micro/nanoparticles in glass or polymer matrix. Consequently, glass-ceramics and oxide@polymer composites are formed. Interaction between introduced phase of oxide particles and the phase of the glass or polymer matrixes can be monitored by analysis of the luminescent characteristics changes.
In this work, the morphology and optical properties of K₂Eu(PO₄)(WO₄) red phosphor, K₂O-P₂O₅-WO₃-Bi₂O₃-K₂Eu(PO₄)(WO₄) glass-ceramics and K₂Eu(PO₄)(WO₄)@ composites have been studied. The Eu3+ ions were used as structural probes due to a dependence of their luminescence properties on symmetry and composition of the nearest surrounding. Effects of interphases and interfaces formation on properties of the materials under study are discussed taking into account the results of optical and scanning electron microscopy, X-ray diffraction, infrared transmittance, diffuse reflectance, and photoluminescence spectroscopy. The studied glass-ceramics and cellulose-based composites have demonstrated perspectives for application as luminescent covers for WLEDs.

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