

Luminescences of Bi³⁺ and Bi²⁺ ions in Bi-doped CaAl₄O₇ phosphor powders obtained via modified Pechini citrate process.

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In the present work, bismuth-doped CaAl₄O₇ phosphor powders were obtained via modified Pechini citrate process and their photoluminescence, radioluminescence and thermally stimulated luminescence properties were studied down to 20K. At room temperature excitation in UV led to broad-band ³P_{0,1} → ¹S₀ Bi³⁺ luminescence with three maxima located in blue-green part of spectrum as well as Bi²⁺ emission around 760nm assigned to the ²P_{3/2} → ²P_{1/2} transition. At 150K an additional Bi³⁺ emission band peaking at 370nm appeared and its intensity increased significantly upon further cooling. The presence of a few luminescent centers of Bi³⁺ in CaAl₄O₇ was assigned to the presence of defects disturbing the local symmetry of activator ions. The radioluminescence spectra showed only two bands, an intense one at 760nm clearly related to Bi²⁺ and a very weak component at 555nm associated with one of the Bi³⁺ sites. These two emissions were also observed in the thermoluminescence of the material following its exposure to X-rays. The Bi³⁺ luminescence is suitably positioned to contribute the cyan color to white-LEDs. Its quantum yield is satisfactory, close to 40%. The Bi²⁺ 720–850nm emission is attractive for bioimaging as it appears in the Ist biological window.

Słowa kluczowe

CaAl₄O₇, Bi³⁺, Bi²⁺, Luminescence, Thermoluminescence, Decay kinetics

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