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Photo- and radioluminescent properties of undoped and Bi-doped Lu_2WO_6 powders at 10-300 K.

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Streszczenie

Undoped and Bi^{3+}-doped lutetium oxytungstate (Lu_2WO_6) powder materials were prepared by a solid state reaction method at selected temperatures between 1000 and 1400 °C. The structural, radio- and photoluminescent properties of these materials were investigated. Upon Bi activation, red-shifts of both emission and excitation bands are observed. While a broad emission band characteristic of undoped Lu_2WO_6 and resulting from a charge transfer transition of the tungstate group WO_6 peaks at 450 nm, the Bi^{3+}-activated Lu_2WO_6 shows a broad band emission peaking at about 510 nm. This emission can be related to the transition between excited and ground states of a deep Bi donor. The ground state of this donor corresponds to an electron-occupied Bi-level at about 0.45 eV above the top of the valence band. Both compositions generate bright radioluminescence upon X-ray excitation at low temperatures. For Lu_2WO_6:Bi the radioluminescence efficiency is roughly stable in the range between 10 and 250 K, while undoped Lu_2WO_6 suffers from moderate thermal quenching above 10 K. The fraction of total radioluminescence due to Bi contribution in Lu_2WO_6:Bi increases from 0.19 at 10 K to 0.53 at room temperature. A simple configuration coordinate diagram is introduced in order to illustrate and describe the charge carrier recombination and light generation mechanism in these materials.

Słowa kluczowe

Lu2WO6, Radioluminescence, Photoluminescence, Deep Bi donor

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