

Lu₂O₃-based storage phosphors : an (in)harmonious family.

Autorzy

Dagmara Kulesza

Paulina Bolek

Adrie J. J. Bos

Eugeniusz Zych

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Streszczenie

Ceramics of Lu₂O₃ activated with either Tb³⁺ or Pr³⁺ and co-doped with one of the transition metal ions – Ti, Hf or Nb – were investigated for their energy storage properties. Photoluminescence, thermoluminescence (TL) and optically stimulated luminescence spectra were recorded and discussed together with thermoluminescent glow curves. The Pr³⁺ and Tb³⁺ ions constitute luminescent centers and participate in the energy storage. However, as the thermoluminescence glow curves showed, the Ti, Hf and Nb co-dopants have a significant impact on glow curve pattern, in particular on the temperature at which the maximum thermoluminescence occurred. For the Tb,Ti and Pr,Ti as well as for the Pr,Nb one main TL peak appeared around 360–370 °C. For other compositions it varied from 210 °C for Tb,Nb, through 230 °C for Tb,Hf to 250 °C for Pr,Hf. In either case additional TL components of lower intensities were observed. They spread over 50–450 °C. The TL data led to the conclusion that the co-dopant – a necessary component to induce a significant energy storage capacity in the materials – may not be directly involved in trapping the excited carriers. Instead, it may rather generate other point defects which, individually or as clusters, would do the work. Energy storage was found to be connected with an appearance of an induced excitation/absorption band spreading over around 350–500 nm and peaking near 400 nm. A prolonged stimulation into this band caused green (for Tb-series) or red (for Pr-series) optically stimulated emission. Such a stimulation allows entirely bleaching out the induced absorption. The optically stimulated luminescence for all members of the Tb-series led to luminescence from both C₂ and C_{3i} sites offered by the host lattice. All compositions of the Pr-series produced optically stimulated emissions upon 400 nm radiation only by means of the Pr³⁺ occupying the C₂ site.

Słowa kluczowe

thermoluminescence, Optically stimulated luminescence,
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