Forcing Eu^{3+} into different positions in the BaHfO$_3$ host and its spectroscopic consequences.

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Streszczenie

Two series of BaHfO$_3$ powders activated with Eu^{3+} ions were prepared with a ceramic method. By stoichiometric variations, the dopant was forced to enter either Ba^{2+} or Hf(IV) sites. X-ray diffraction (XRD) analysis proved that Eu^{3+} ions preferred substitution of Hf(IV) in BaHfO$_3$, while replacement of Ba^{2+} encountered difficulties and led finally to separation of a foreign phase, Eu$_2$Hf$_2$O$_7$. Yet, it was shown that the host always incorporated the activator both into Hf(IV) and Ba^{2+} positions, and the two sites, $\mathrm{Eu}_{\mathrm{Hf}}'$ and $\mathrm{Eu}_{\mathrm{Ba}}^{\bullet}$, were spectroscopically characterized. From photoluminescence spectra, it appeared that $\mathrm{Eu}_{\mathrm{Ba}}^{\bullet}$ gave emissions at 573.6, ∼595, and 626.0 nm, while luminescence from $\mathrm{Eu}_{\mathrm{Hf}}'$ was practically limited to just one line peaking at 595.6 nm. Luminescence and excitation spectra taken under synchrotron radiation showed that energy from the excited host is preferentially transferred to $\mathrm{Eu}_{\mathrm{Hf}}'$ compared to $\mathrm{Eu}_{\mathrm{Ba}}^{\bullet}$. At 10K, the latter was not capable of intercepting any energy upon excitation above the fundamental absorption of BaHfO$_3$, which limited the luminescence in such conditions to a single line peaking at 595.6 nm. Also, under excitation with X-rays, practically only the $\mathrm{Eu}_{\mathrm{Hf}}'$ was able to produce luminescence.

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https://www.acs.org/content/acs/en.html