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Near-infrared luminescence of rare earth ions in oxyfluoride lead borate glasses and transparent glass-ceramic materials

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Keywords

oxyfluoride glasses, transparent glass-ceramics, rare earth ions, luminescence

Abstract

Oxyfluoride lead borate glasses singly doped with Nd^{3+} and Er^{3+} ions have been studied before and after thermal treatment. The orthorhombic PbF_2 crystallites are formed during thermal treatment, which was evidenced by X-ray diffraction analysis. Near-infrared luminescence spectra at $1.06 \mu\text{m}$ and $1.53 \mu\text{m}$ have been registered for samples before and after annealing, which correspond to the main ${}^4F_{3/2} - {}^4I_{11/2}$ and ${}^4I_{13/2} - {}^4I_{15/2}$ laser transitions of Nd^{3+} and Er^{3+} ions, respectively. Luminescence decays from ${}^4F_{3/2}$ state of Nd^{3+} and ${}^4I_{13/2}$ state of Er^{3+} have been analyzed in detail. Contrary to Nd-doped samples, the luminescence lines obtained for Er-doped transparent oxyfluoride glass-ceramics are more intense and narrowed, whereas the luminescence decays from ${}^4I_{13/2}$ state of Er^{3+} are slightly longer in comparison to precursor glasses.

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