



Comparative optical study of thulium-doped YVO_4 , GdVO_4 , and LuVO_4 single crystals.

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Streszczenie

$\text{YVO}_4\text{:Tm}^{3+}$ crystals grown by the Czochralski technique and $\text{GdVO}_4\text{:Tm}^{3+}$ and $\text{LuVO}_4\text{:Tm}^{3+}$ crystals grown by the floating-zone technique were investigated using methods of optical spectroscopy. Polarized absorption and emission spectra were recorded at room temperature and at 6 K. The crystal-field analysis was performed assuming the D_{2d} site symmetry for Tm^{3+} ions. In this way the missing crystal-field components of the 3H_6 ground multiplet were located. Room temperature absorption spectra were analyzed in the framework of the Judd-Ofelt theory. Evaluated radiative lifetimes of luminescent levels of Tm^{3+} follow a general trend diminishing in agreement with the sequence: $\text{YVO}_4\text{:Tm}^{3+} \rightarrow \text{GdVO}_4\text{:Tm}^{3+} \rightarrow \text{LuVO}_4\text{:Tm}^{3+}$. Luminescence lifetimes measured for the systems under study are similar except for the 3F_4 lifetime, which appears to be surprisingly short for $\text{LuVO}_4\text{:Tm}^{3+}$. Anisotropy of optical spectra is particularly pronounced in $\text{LuVO}_4\text{:Tm}^{3+}$. Peak absorption cross section for the band relevant for optical pumping at about 805 nm is roughly three times higher for polarization. Stimulated emission cross sections for the 3F_4 - 3H_6 transition near 1800 nm were evaluated using the reciprocity method. The diode-pumped continuous wave laser operation in $\text{GdVO}_4\text{:Tm}^{3+}$ with a slope efficiency of up to 40% is demonstrated. In $\text{LuVO}_4\text{:Tm}^{3+}$ the diode-pumped laser oscillation in a pulsed mode was observed.

Adres publiczny

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