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A study of optical properties of Tm^{3+} ions in $Y_2Te_4O_{11}$ microcrystalline powder.

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The $Y_{2-x}Te_4O_{11}$ (x=0.1, 0.5, 1.0, 2.0 and 5.0at%) microcrystalline powders were successfully synthesized by a conventional solid state reaction method. Optical absorption (300K) and fluorescence spectra (300K) as well as fluorescence decay curves (300K) of the emitting levels of Tm^{3+} ion in $Y_2Te_4O_{11}$ powders are presented and analyzed in details. The Judd-Ofelt theory was applied to analyze experimental data for the quantitative determination of phenomenological Ω_λ (λ=2, 4, 6) parameters, radiative transition probabilities (A), branching ratios (β) of luminescence and radiative lifetimes (τ_{rad}) of the $^1D_2$, $^1G_4$, $^3H_4$ and $^3F_4$ levels. The observed non-exponential decays nature and concentration quenching of the $^1G_4$ and $^3H_4$ states have been attributed to cross-relaxation processes and this phenomena has been analyzed by Inokuti-Hirayama model. The stimulated emission cross-section for the $^3F_4 \rightarrow {}^3H_6$ transition equals to 1.12×10^{-20} cm^2 at 1809nm was calculated using the Füchtbauer-Ladenburg method and compared with the corresponding values of other Tm^{3+}-doped laser hosts. From obtained results, follow that the Tm^{3+}:$Y_2Te_4O_{11}$ is a potential candidate for a solid-state laser host operating at 1.8μm.

Słowa kluczowe

Tm3+, oxotellurates, energy transfer, laser material

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