

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 ($\lambda=2, 4, 6$) 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 $1.12 \times 10^{-20} \text{ cm}^2$ 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 $1.8\mu\text{m}$.

Słowa kluczowe

Tm³⁺, oxotellurates, energy transfer, laser material

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