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# A study of optical properties of $\text{Tm}^{3+}$ ions in $\text{Y}_2\text{Te}_4\text{O}_{11}$ microcrystalline powder

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## Abstract

The  $\text{Y}_{2-x}\text{Te}_4\text{O}_{11}$  ( $x = 0.1, 0.5, 1.0, 2.0$  and  $5.0$  at%) microcrystalline powders were successfully synthesized by a conventional solid state reaction method. Optical absorption (300 K) and fluorescence spectra (300 K) as well as fluorescence decay curves (300 K) of the emitting levels of  $\text{Tm}^{3+}$  ion in  $\text{Y}_2\text{Te}_4\text{O}_{11}$  powders are presented and analyzed in details. The Judd-Ofelt theory was applied to analyze experimental data for the quantitative determination of phenomenological  $\Omega_\lambda$  ( $\lambda = 2, 4, 6$ ) parameters, radiative transition probabilities ( $A$ ), branching ratios ( $\beta$ ) of luminescence and radiative lifetimes ( $\tau_{rad}$ ) of the  $^1\text{D}_2$ ,  $^1\text{G}_4$ ,  $^3\text{H}_4$  and  $^3\text{F}_4$  levels. The observed non-exponential decays nature and concentration quenching of the  $^1\text{G}_4$  and  $^3\text{H}_4$  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  $^3\text{F}_4 \rightarrow ^3\text{H}_6$  transition equals to  $1.12 \times 10^{-20} \text{ cm}^2$  at 1809 nm was calculated using the Füchtbauer-Ladenburg method and compared with the corresponding values of other  $\text{Tm}^{3+}$ -doped laser

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