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Structural and spectroscopic characterizations of two promising Nd-doped monoclinic or tetragonal laser tungstates.

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The tetragonal $Cd_{0.25}Nd_{0.50}\square_{0.25}WO_4$ compound (□ – statistically distributed vacancies in cation sublattice) and its gadolinium diluted $Cd_{0.25}Gd_{0.50}\square_{0.25}WO_4$:$Nd^{3+}$ analogue as well as the monoclinic $CdNd_2W_2O_{10}$ phase and its yttrium diluted $CdY_2W_2O_{10}$:Nd^{3+} analogue were synthesized by the high temperature solid-state reaction. The gadolinium or yttrium diluted samples were doped with different concentrations of the active Nd^{3+} ion: 0.25, 0.5, 2.5 and 5 mol%. X-ray powder diffraction, IR spectra as well as electron microscopy (SEM and HRTEM) were used to identify their structure and morphology. All micromaterials were obtained as spherical particles with average diameters between 1 and 10 μm. In order to study their spectroscopic properties, high resolution absorption and emission spectra in the visible and IR regions were measured at room temperature, 77 K and 4 K. The kinetics of luminescence from the lowest $^4F_{3/2}$ energy level as a function of the Nd^{3+} ion concentration and temperature is also reported. Both the values of the absorption cross-section calculated for 5 mol% of Nd^{3+} ion, and the very strong emission of the $^4F_{3/2} \rightarrow {}^4I_{11/2}$ laser channel of Nd^{3+} recorded under Xe lamp excitation or OPO laser pumping, indicate that the scheelite-type $Cd_{0.25}Gd_{0.50}\square_{0.25}WO_4$:$Nd^{3+}$ phase can be considered as a promising laser material. The radiative lifetimes of IR luminescence are also appropriate for potential applications of this phosphor as a solid-state laser.

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