Growth, spectroscopy and first laser operation of monoclinic Ho^{3+} :$MgWO_4$ crystal

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Abstract. A monoclinic 0.86 at.% Ho^{3+}:$MgWO_4$ crystal is grown by the Top-Seeded-Solution Growth method. Its spectroscopic properties are studied with polarized light for E || a, b, c. The Ho^{3+} ion transition probabilities are determined within the modified Judd-Ofelt theory (mJ-O) accounting for the configuration interaction. The intensity parameters are Ω2 = 21.09, Ω4 = 4.42, Ω6 = 2.28 [10–20 cm^2] and α= 0.053 [10-4cm]. The calculated radiative lifetime of the 5I7 state is 6.18 ms. The Stark splitting of the 5I7 and 5I8 multiplets is determined with low-temperature spectroscopy. The absorption, stimulated-emission (SE) and gain cross-sections for the 5I8↔5I7 transition are derived. Ho^{3+} :$MgWO_4$ features a large Stark splitting of the ground-state (380 cm-1), high maximumσSE of 1.82 × 10–20 cm^2 at 2.083μm, broad gain spectra and high luminescence quantum yield making it suitable for efficient continuous-wave and mode-locked lasers at~2.1μm. First laser operation of Ho^{3+}:$MgWO_4$ crystal is demonstrated at 2.104μm reaching a slope efficiency of 72%.

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