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Highly efficient high power CW and Q-switched Ho:YLF laser

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Abstract:

An efficient operation of a Ho:YLF laser pumped by a Tm-doped fibre laser is reported. The research in a continuous-wave (CW) operation was done for two crystals of the same 0.5 at.%Ho dopant concentration and with different lengths ($3\times3\times30\text{ mm}^3$ and $3\times3\times50\text{ mm}^3$). For an output coupling transmission of 20% and a crystal length of 50 mm, the maximum CW output power of 38.9 W for 81.4 W of incident pump power, corresponding to the slope efficiency of 52.3% and optical-to-optical conversion efficiency of 47.8% (determined with respect to the incident pump power) was achieved. The highest optical-to-optical conversion efficiency of 70.2% with respect to the absorbed pump power was obtained. The influence of a heat-sink cooling water temperature on the CW laser performance was studied. For a Q-switched operation the pulse repetition frequency (PRF) was changed from 2 to 10 kHz. The maximum average output power of 34.1 W at the PRF of 10 kHz was obtained for a 50 mm holmium crystal length. For 2 kHz PRF and 71.9 W of incident pump power, pulse energies of 13.7 mJ with a 21 ns FWHM pulse width corresponding to 652 kW peak power were recorded.