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Diode-pumped CW Tm:GdVO₄ laser at 1.9 µm

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A high power cryogenic cooling Tm-doped (2%) GdVO₄ laser double-end-pumped by fiber-coupled-diode with the center wavelength of 804.5 nm at 21°C is reported. The highest continuous-wave (CW) power of 2.35 W at 1903 nm is attained at pump power of 24 W. The slope efficiency is 12.5% and the threshold is 3.2 W. Singles and double-end-pumped types are investigated.

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wavelength can be changed by running temperature of diode in a small range) and find the relationship between input power and output power. As shown in Fig. 3, the optimum running temperature is 21 °C with the center wavelength of about 804.5 nm, maximum output power is 2.35 W and slope efficiency is 12.5%. There is no obvious difference between the lines at 22 and 20 °C. When the diode laser operates at 26 °C, the output power and slope efficiency (8%) are much lower than others.

We investigated single- and double-end-pumped system, as shown in Fig. 4. The threshold of double-end-pump is 3.2 W which is much lower than that of 13 W in single-end-pumped system, this is because that the re-absorption and thermal effect in local area in single-end-pumped crystal are very heavy. It is necessary to use double-end-pumped system to increase the length of active region, reduce re-absorption effect, lower local heat congestion and then decrease threshold. The slope efficiencies of two types are approximate 12.5% for double-end-pump and 11% for single-end-pump. The maximum output power is 2.35 W at 1903 nm with linewidth of 2.6 nm (FWHM). The output transversal mode is TEM00.

In this experiment a diode-pumped 2.35-W CW Tm:CeV3 laser is demonstrated, the threshold is 3.2 W and slop efficiency is 12.5%. The optimum pump wavelength is 804.5 nm when the diode laser operates on 21 °C. For higher power and conversion efficiency in the future, it is needed to optimize Tm concentration, crystal length, and resonator parameters, this work is still in progress.

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References