Investigations of room temperature, diode-side-pumped Yb:LuAG slab laser

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Abstract—High gain, side pumped by fast axis collimated laser diode stack, Yb:LuAG slab laser was examined. 87 mJ of energy with 20.9 % slope, small signal gain of 6.1 was demonstrated in room temperature.

Keywords—lasers; solid state lasers; ytterbium; diode pumped

An increased interest to Yb:LuAG due to its excellent thermo-optical and laser properties has been observed for last few years [1]. The aim of this work was to examine its feasibility as a gain medium for 0.1 J-class energy, room-temperature oscillators.

The 15 at. % Yb:LuAG slab of 3x3x12 mm$^3$ dimensions was side-pumped by 2D fast-axis-collimated LD stack, delivering up to 0.62 J in 0.8-ms duration pump pulse at 970 nm wavelength. Pump beam was tightly focused in y-axis by means of cylindrical lens to 0.4-mm width, delivering 13 J/cm$^2$ pump density onto entrance sidewall of Yb:LuAG slab (see Fig. 1).

The best results for 150-mm length cavity were demonstrated for OC transmission of 86%. We have achieved for maximal pump energy of 0.62 J up to 87 mJ of output energy with 20.8% of slope efficiency (see Fig. 2).

Due to aperture reabsorption losses $M^2$ parameter in y-axis was < 1.5, whereas in x-direction was above 3. We have observed significantly higher gain comparing to the similar Yb:YAG slab laser [2] measured in the same set up. The estimated net roundtrip gain is 6.1 corresponding to 2.54 cm$^{-1}$.

Fig. 1. Scheme of diode-side-pumped Yb:LuAG laser.

Fig. 2. Energetic characteristic of Yb:LuAG laser for different output transmissions.

REFERENCES


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