

Ho:KLuW LASER PASSIVELY Q-SWITCHED BY A PbS QUANTUM DOT-DOPED GLASS

PhD student Serres J.M., Dr. Mateos X., Prof. Aguiló M., Prof. Díaz F.
University Rovira i Virgili, Tarragona, Spain
Dr. Loiko P.A., Prof. Malyarevich A.M., Prof. Yumashev K.V.
Belarusian National Technical University, Minsk, Belarus

Holmium lasers emitting at $\sim 2 \mu\text{m}$ ($^5I_7 \rightarrow ^5I_8$ transition of Ho^{3+} ion) are used in remote sensing, metrology and medicine. Well-established hosts for Ho doping are the monoclinic double tungstates crystals, e.g. $\text{KLu}(\text{WO}_4)_2$ or KLuW. In the present work, we report on passive Q-switching (PQS) of inband-pumped Ho:KLuW laser with the lead sulphide, PbS, quantum dot (QD) doped silicate glass. The laser geometry corresponded to microchip configuration which provides small cavity roundtrip time and, hence, short pulses.

A 3 at.% Ho:KLuW crystal was grown by the TSSG method. It was cut along the N_g -axis (2.67 mm thick) and it inserted into a plano-plano cavity. The crystal was pumped by a Tm:KLuW laser at 1946 nm. The studied output couplers had a transmission $T_{\text{OC}} = 1.5\%$ and 5% at the laser wavelength. PbS QD saturable absorber was $235 \mu\text{m}$ thick. The total cavity length was 2.91 mm and it contained no air gaps.

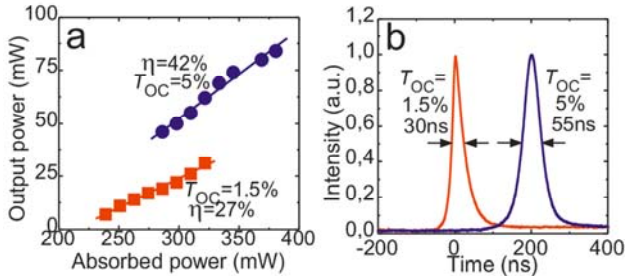


Figure 1 – (a) Output-input dependences and (b) oscilloscope traces of the shortest Q-switched pulses for Ho:KLuW laser

The shortest pulse duration was achieved with $T_{\text{OC}} = 1.5\%$, corresponding to a pulse duration of 30 ns at a repetition rate of 62 kHz. The highest average output power of 84 mW was achieved with $T_{\text{OC}} = 5\%$ and the laser operated at $2.06 \mu\text{m}$. It also showed the highest slope efficiency of 42%, maximum pulse energy of $1.2 \mu\text{J}$ and peak power of $\sim 22 \text{ W}$. The conversion efficiency with respect to CW operation mode amounted to $\sim 80\%$.

Further improvement of this laser is possible with PbS SAs having larger modulation depth.