

An investigation into the electro-optically Q-switched Tb:LiYF₄ green laser

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Tb³⁺ ions doped lasers have become interesting research topics due to the characteristic that its energy transition (Tb³⁺: ⁵D₄→⁷F₅) can directly produce laser radiation at green waveband, which has great potential for the above-mentioned applications. In addition, it is worth noting that the upper level of Tb³⁺ ions have a relatively longer lifetime (typically ~5 ms for Tb³⁺ doped), which gives it a good capability for energy storage. Most recently, our group has demonstrated an actively Q-switched Tb:LiYF₄ laser by acousto-optic Q-switching for the first time, which produced a pulse energy of 148 μJ and peak power of 580 W at 3 kHz repetition rate [1].

In this work, we have demonstrated the electro-optically Q-switched operation of a Tb:LiYF₄ green laser for the first time. Typical pulse trains at different repetition rates are shown in Fig. 1 (a, b). We can see that the EO Q-switched laser was working stably at each repetition rate at the maximum absorbed pump power of 1.6 W. Figure 1 (c) summarizes the pulse width and the peak power achieved in the Q-switched Tb:LiYF₄ laser operated at several repetition rates at the maximum absorbed power of 1.6 W. The pulse width of decreased from 388 ns to 248 ns with the repetition frequency changing from 50 kHz to 200 Hz, while the peak power continued increasing from 2.4 W to 797 W. To the best of our knowledge, this is the highest output peak power generated from an Tb:LiYF₄ laser.

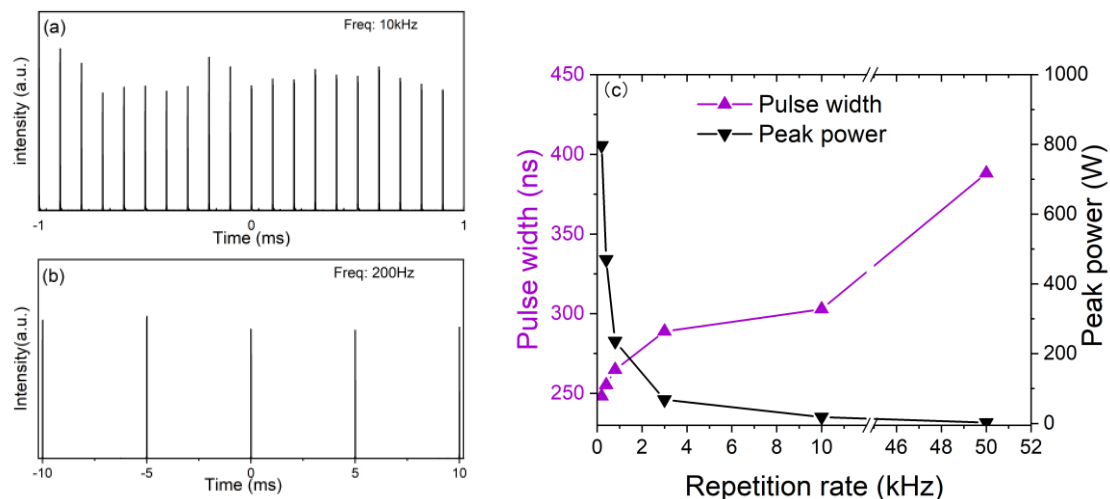


Fig. 1. (a, b) Variation of the typical pulse train with different Freq (c) Pulse width and peak power plotted with repetition rate at absorbed pump power of 1.6 W.

References

[1] H. Chen, W. Yao, H. Uehara and R. Yasuhara, "Actively Q-switched Tb:LiYF₄ green lasers," Appl. Phys. Express 14(062002), (2021).