

# Non-stop signal achieved in high-power Erbium-doped mid-infrared lasers

July 1 2021, by Zhang Nannan

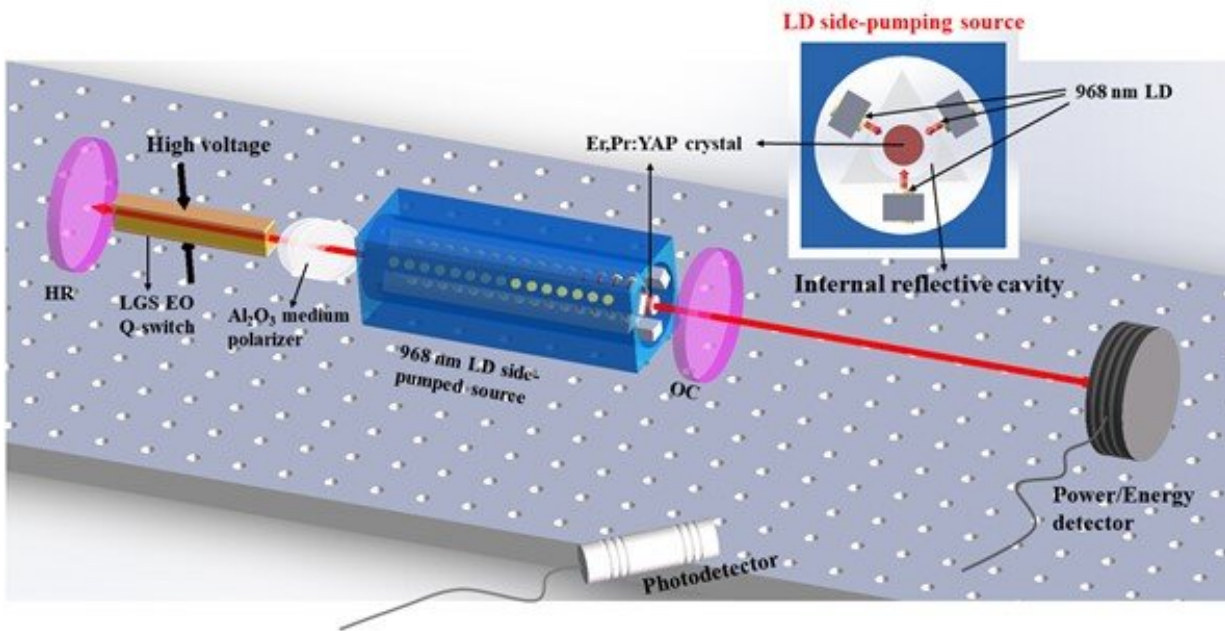


Fig. 1. Schematic of LD side-pumped Er(Pr):YAP laser. Credit: QUAN Cong

The Mid-infrared lasers (MIR) with high peak power and high repetition rate operating in the range of 2.7~3  $\mu\text{m}$  have important application in laser surgery and optical parametric oscillator (OPO).

A recent study conducted by Sun Dunlu's research group at the Hefei Institutes of Physical Science (HFIPS) of the Chinese Academy of

Sciences (CAS) achieved high power, [high efficiency](#) and quasi-continuous mid-infrared [laser](#) in the free running and langasite [La<sub>3</sub>Ga<sub>5</sub>SiO<sub>14</sub> (LGS)] Q-switched modes by using the Er<sup>3+</sup> ions-doped YAP crystals as laser gain medium.

Based on their previous research work on laser, the researchers further improved the laser performance of Er:YAP laser crystal by laser-diode (LD) side-pumping method, a Er:YAP crystal rod with concave end-faces was used to compensate the thermal lensing effect. The maximum output powers of 26.75 W were achieved at 250 Hz, and 13.18 W at 1000 Hz, which is the highest working frequency in all the LD side-pumped Er-doped MIR laser so far.

In addition, they demonstrated a LD side-pumped and electro-optical Q-switched Er,Pr:YAP laser with emission at 2.7 μm. A giant pulse laser was obtained with pulse energy of 20.5 mJ, pulse width of 61.4 ns, and peak power of 0.33 MW at the highest working frequency of 150 Hz.

These results indicate that the Er<sup>3+</sup>-doped YAP crystals are promising candidate for the [high power](#) and high frequency mid-[infrared laser](#) device, which possess great potential for the application of dental ablation surgery and OPO pump source.

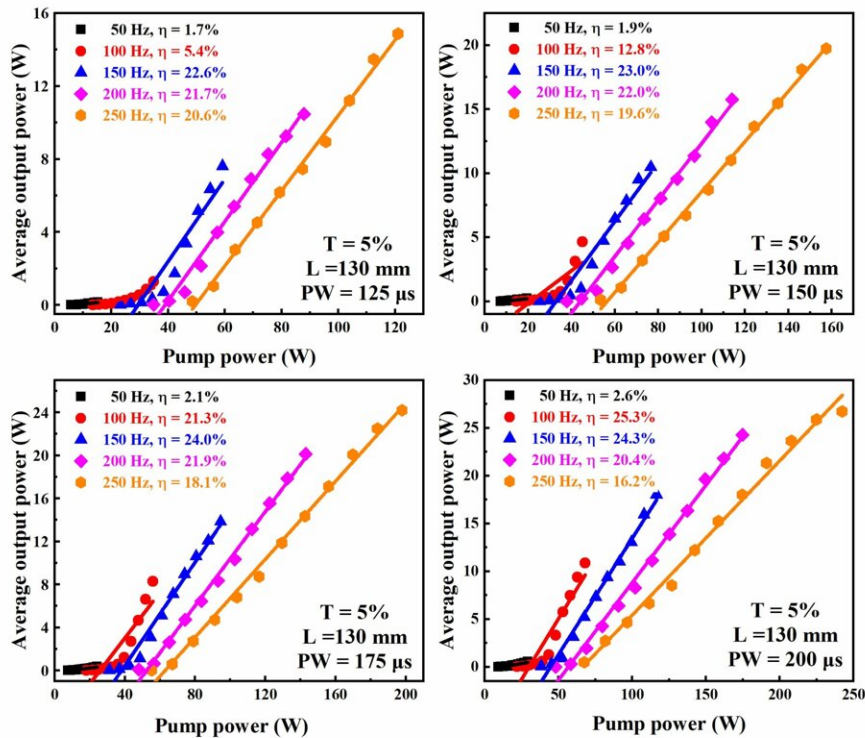


Fig. 2. Average output power of LD side-pumped Er:YAP laser versus pump power at different working frequencies and pump pulse widths. Credit: QUAN Cong

**More information:** Cong Quan et al, 13-W and 1000-Hz of a 27- $\mu\text{m}$  laser on the 968 nm LD side-pumped Er:YAP crystal with concave end-faces, *Optics Express* (2021). [DOI: 10.1364/OE.428874](https://doi.org/10.1364/OE.428874)

Cong Quan et al, Performance of a 968-nm laser-diode side-pumped, electro-optical Q-switched Er,Pr:YAP laser with emission at 2.7  $\mu\text{m}$ ,

*Optical Engineering* (2021). [DOI: 10.1117/1.OE.60.6.066112](https://doi.org/10.1117/1.OE.60.6.066112)

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