Low-cost 2-micron Laser Scalpel Uses Ceramic Gain Materials

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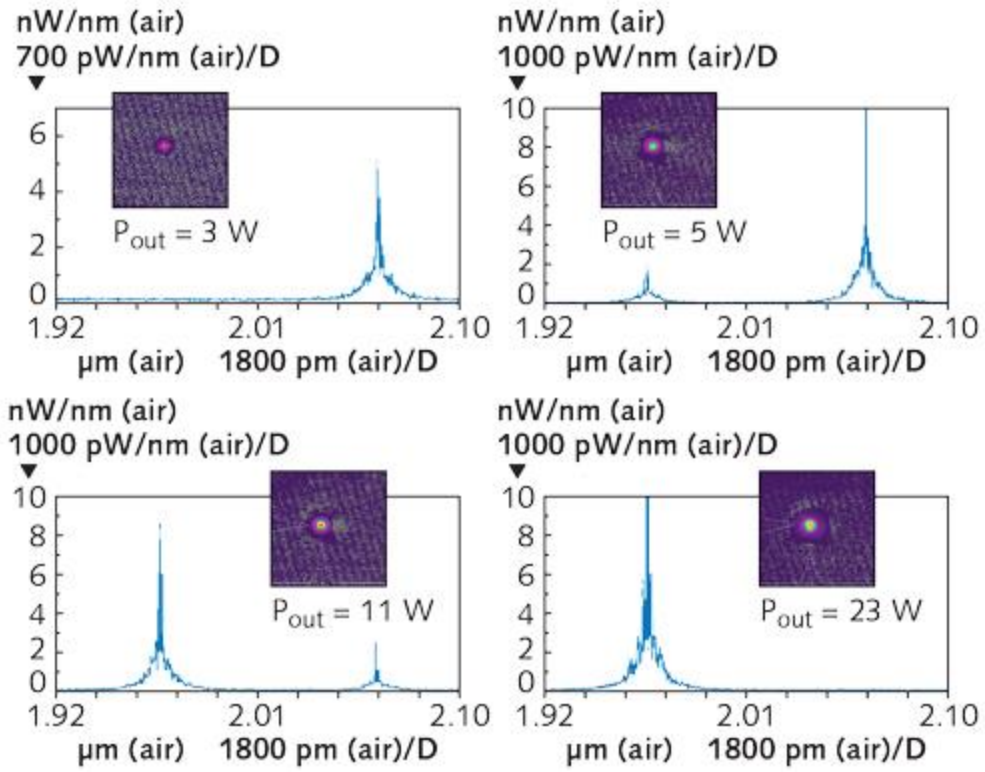
Scientists from the Russian Academy of Sciences and Nizhniy Novgorod State University (both in Nizhniy Novgorod, Russia) and NTO IRE-Polus and the Moscow Institute of Physics and Technology (both in Moscow, Russia) have developed a ceramic-based laser that cuts tissue with minimal trauma and is at least two times less expensive than lasers using high-quality crystal-grown lasing materials.



Most 2 μm lasers—proven superior for surgical applications because of easy absorption of this wavelength by water molecules in human tissue without large penetration depth—use thulium (Tm)- or holmium (Ho)-doped laser glasses to achieve high peak powers. However, the Russian scientists pumped a thulium lutetium oxide (Tm^{3+}:Lu_2O_3) ceramic laser with a 1670 nm Raman-shifted erbium fiber laser (RSEFL) to achieve both continuous-wave (CW) and *Q*-switched operation with excellent beam quality. Specifically, 23 W CW with 59.1% optical-to-optical conversion efficiency and 15 W average power for *Q*-switched mode with 40–80 ns pulse duration and 15 to 30 kHz repetition rate were observed for lasing at 1966 and 2064 nm, with different oscillation spectra and far-field profiles as a function of laser output power. The Lu_2O_3 sesquioxide ceramic overcomes the problem of single-crystal growth at high melting temperatures (above 2400°C), and allows the preparation of larger gain components with higher thulium concentrations at lower cost for more economical surgery and lithotripsy compared to 2 μm crystal or fiber lasers. *Reference: O. Antipov et al*., Opt. Lett., *41, 10, 2298–2301 (May 15, 2016)*.