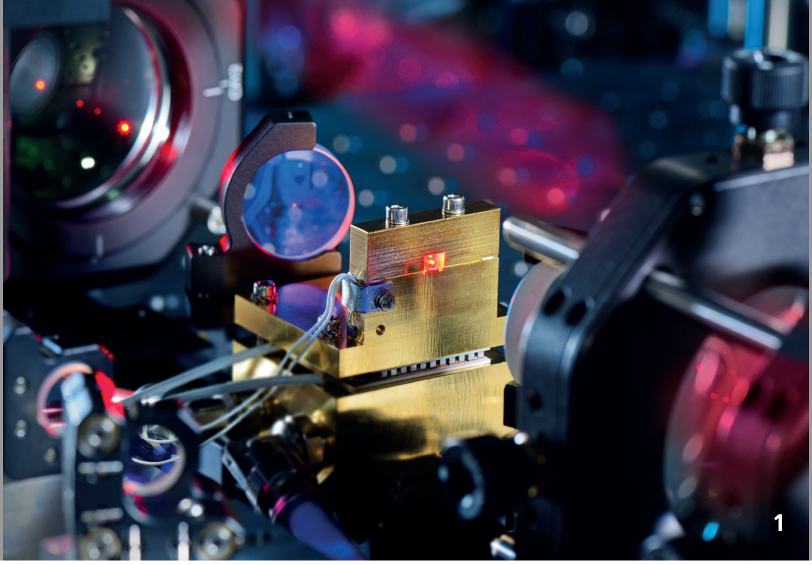

Subject to alterations in specifications and other technical information. 06/2020.

CONTINUOUSLY DIODE-PUMPED ALEXANDRITE LASER WITH 6.5 W OUTPUT POWER

Task

Scaling the output power and efficiency of continuously emitting diode-pumped alexandrite lasers is an ongoing subject of research. Thanks to their tuning range between 700 - 800 nm, they provide access to atomic and ionic resonance lines. When alexandrite is pumped with laser diodes in the red spectral range, these lasers have higher efficiency, a smaller installation space and lower thermal load compared to pumping them with flash lamps. To extend the application potential, Fraunhofer ILT has increased the output power in the transverse fundamental mode compared to the current state of the art.

Method

The laboratory setup of a longitudinally diode-pumped alexandrite laser is used to demonstrate the potential of scaling the laser to higher powers. The alexandrite crystal is pumped longitudinally with laser radiation at the wavelength of 638 nm. For this purpose, the output beams of two commercial diode modules are polarization-coupled and the transverse properties symmetrized with a step mirror. A total pump power of up to 58 W is achieved with a beam quality of $M_x^2 = 100$ and $M_y^2 = 110$.

Results

Fraunhofer ILT has demonstrated a continuous-wave power of 6.5 W at 25 W absorbed pump power from its alexandrite laser in fundamental-mode operation ($M^2 = 1.1$), a power that sets the current record for diode-pumped alexandrite lasers. The free-running wavelength at maximum power is 752 nm.

The result underscores the potential of diode-pumped alexandrite lasers for the emission of laser radiation tunable in a wide spectral range with average output powers in the watt range. Current investigations are helping us better understand thermal effects in the crystal in order to operate the laser efficiently at even higher pump powers.

Applications

The arrangement can be extended to investigate the generation of ultrashort pulses by mode locking since alexandrite has a large gain bandwidth. Furthermore, frequency doubling within the resonator makes it possible to generate tunable laser radiation in the UV in a single conversion step.

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1 Continuously diode-pumped alexandrite laser.

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