



YTTERBIUM-INNOSLAB-ULTRA-SHORT-PULSE AMPLIFIER PLATFORM FOR MULTI-KW-OUTPUT POWERS

Task

Ultrashort-pulse (UKP) laser sources based on Yb:YAG as active medium currently achieve output powers of around 1 kW. Scaling the output power by up to one order of magnitude promises to open up new applications.

Method

The existing Ytterbium-INNOSLAB amplifier platform developed by Fraunhofer ILT is designed for approx. 500 W extracted power per amplifier stage and achieves output powers greater than 1 kW by cascading two stages. The institute is developing a completely new amplifier platform designed for greater than 1500 W of extracted power per amplifier stage. By cascading these amplifier stages, Fraunhofer ILT intends to achieve output powers of up to 5 kW.

Results

Essential core components of the INNOSLAB amplifier architecture have been fundamentally redesigned or refined:

- A new modular pumping arrangement developed and patented by Fraunhofer ILT was used, in which the radiation from up to six modules is geometrically superimposed in the crystal.

- The slab crystal package was adapted for the increased output power, and the soldering technology required for thermal contacting was successfully refined.
- Arrangements for high-gain operation of the amplifier modules, enabling output powers greater than 1.5 kW at seed powers less than 50 W, have been designed, simulated, and are undergoing experimental testing.

Applications

The scaled UKP laser parameters show great promise for applications in high-throughput microstructuring, for example in the field of electromobility, as well as in laser-driven generation of secondary radiation.

The R&D project underlying this report has been funded within the Fraunhofer Cluster of Excellence Advanced Photon Sources CAPS. The laser source is made available to partners from industry and research in the CAPS application infrastructure for them to run application studies and experiments.

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1 Detailed view of the amplifier platform.