

Press Release

Studies of ultrafast processes down to the atomic level enabled by AMPHOS Lasertechnology

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Amphos GmbH and the laser group of the European XFEL GmbH have successfully joined their expertise in the development of a burst-mode power amplifier as part of a unique laser system for experiments at the European XFEL light source, currently under construction in the Hamburg area, Germany. Following successful prototype development and intense longterm testing for more than one year, the installation and commissioning of the first 5kW sub-picosecond pump amplifier chain, belonging to the pump-probe laser system at the SASE 1 beamline, has started.

The European XFEL GmbH is developing high power burst mode femtosecond pump-probe lasers, based on non-collinear optical parametric amplification (NOPA), to be used for experiments in combination with the facilities x-ray beams. The facility's ultrashort, high-intensity X-ray laser pulses will enable studies of ultrafast processes in solids, gas-phase, chemical and biomolecular structures, and extreme states of matter down to the atomic level. Its pump-probe lasers will typically activate samples, followed by probing with the X-ray pulses. These laser sources rely on very high burst-power (5kW) and high-energy (50mJ-per-pulse) sub-picosecond pulses at 1- μ m wavelength, arranged in low duty cycle bursts at 10-20Hz, to pump the NOPA stages. A key component in achieving the pump-probe laser specifications is therefore this highly specialized pump amplifier.



Foto: 5kW Amplifier Chain installed at XFEL lab at SASE 1 beamline

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Amphos GmbH contributed their expertise in design and manufacturing of industrial grade high power laser systems and laser components, based on the slab geometry, such as gain modules, isolators and Pockels-cells. In particular, the proprietary high gain Yb:YAG InnoSlab amplifier technology was the key in achieving the required burst power of >5kW for intra-burst repetition rates of 0.1 - 4.5MHz. The scheme consists of a 400W standard Amphos InnoSlab amplifier followed by the entirely newly developed large aperture double-pass InnoSlab booster amplifier. Seeded by the European XFEL chirped-pulse front-end amplifier, the combination produces highly stable output with nearly diffraction limited beam quality. Industrial grade packaging, manufacturing and testing, together with the integration into the European XFEL control system will provide long term reliable operation and remote monitoring.