Development of high-average power extreme ultra violet source by laser produced plasmas

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Extreme ultraviolet (EUV) radiation from laser-produced plasma has recently attracted particular attention for use in production of the next generation semiconductor devices of node-size below 40 nm. It is expected to generate over 115 W at 13.5 nm within 2% bandwidth at the repetition rate of 7-10 kHz. Since 2003 a new project of MEXT has started to provide experimental and theoretical databases for clean and efficient EUV generation, and technical guidelines to build-up an EUV-source system for practical use in industry. The main tasks of the project are

(1) **Acquirement of databases**: Comprehensive experimental databases are provided for a wide range of parameters of lasers and targets. These experimental data will be utilized to benchmark a radiation hydrodynamic code including equation-of-state solvers and advanced atomic kinetic models dedicated for EUV plasma prediction.

(2) **Target design and fabrication**: Various types of targets have been proposed such as gas, liquid, low-density solid or clusters. In addition, innovative targets are desired in order to attain acceptably high conversion efficiency and mitigate debris from targets.

(3) **Establishment of laser technology**: A 5-kW laser at a repletion rate of 5-kHz system is ready to demonstrate efficient EUV source generation under optimized plasma conditions.

Present status of the laser produced EUV source development and future prospects for various applications will be discussed.