TARGET FABRICATION AT SHANGHAI INSTITUTE OF LASER PLASMA

Zhiyong Xie, Junjian Ye, Xiuguang Huang, Guo Jia, Jiaqin Dong, Hua Shu
Shanghai Institute of Laser Plasma, Shanghai, China
Email:xiezhiyong1982@hotmail.com

Shanghai Institute of Laser Plasma (SILP) researchers performed experiments on SG II in the areas of equation of state (EOS), Rayleigh-Taylor instability, and fast ignition and so on. Various types of planar targets were needed. The target fabrication process at SILP is described in this paper.

The EOS targets were composed of several layers of different materials. Target thicknesses are usually required to be within 1 micron of a nominal thickness that can range from a few microns to well over 100 microns. The thickness of each target must be uniform over the entire area of interest and must be reported with a precision of one-tenth of a micron. The metal foils were fabricated by 30-roll cold rolling mill with good surface finishes. A polishing process was applied to improve the foils' surface morphology in order to meet the requirement of the EOS experiments. The polished metal foils were cut to precise size by picosecond laser processing. The sizes of the metal foils were variational depending on the target configurations, and the minimum width may be less than 100 microns. The hydrocarbon foils were also widely used in EOS experiments and they were made by chemical methods. A metallic coating, primarily aluminum, was applied to the polymer films by sputter or evaporation when it's demanded. Step layer may have up to five thin foils in less than 1 millimeters wide area. The layers were stacked and bonded together to form the target only by their Vander Waals force. Two cover plates with holes in the center were used to fix the targets as the target frame. Several methods were used to precisely measure and characterize the final target and target parts including white light interferometers, optical microscopes, and surface profilometers. Various types EOS targets such as isentropic release targets, impedance-matching targets, and multi-step targets with different configurations had been fabricated for EOS experiments at SILP.

The polystyrene (CH) and aluminum (Al) planar perturbation targets were designed and fabricated. Sinusoidal patterns were introduced on the surface of Al foils using a single-point diamond turning machine. The polystyrene (CH) planar perturbation targets were then fabricated via spin-coating process. Perturbation periods were 16~150μm and peak-to-valley were several micron, the thickness of the targets were 10~50μm. Many kinds of CH, Al and CH/Al dual-layer perturbation targets were fabricated for Rayleigh-Taylor instability experiments.