§31. Preliminary Study of Chamber Engineering for Fast Ignition Laser Fusion Reactor

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One of the major problems in the technological feasibility of the inertial confinement fusion reactor is the chamber that should accept pulsed load of radiation, ion particles and debris and be pumped out in the repeated pulsed operation cycle of several Hz. Especially in a fast ignition scenario, lead (or lithium lead) cones attached to the target fuel pellets add specific material transfer issues such as deposition on the chamber wall, ablation, and formation of clusters that are suspected to affect the pumping characteristics (Fig.1). Ablated metal particles from the wall are suspected to form various sizes of clusters that fly slower and more difficult to evacuate. This collaborative research will investigate the basic behavior of the ablated particles from the surface simulating laser fusion chamber.

Figure 2 illustrates the setup of the experimental apparatus using the EUV database laser and the target chamber at ILE, Osaka Univ. Thomson parabola is used for ion energy and charge state measurements, the quadrupole mass spectrometer is for detection of polymer particle, and the charge collector is for ion current of ablated particle along the time.

The fisical year 2005, we used the QMS with SEM, and tried to measure time variation of specific mass number synchronized to the laser pulse, as the the mass scanning time of a QMS is not fast enough compared with decay time of ablated partices in the chamber. Two experimental campaigns of 2 weeks each were performed in the fiscal year 2005.

With Pb target, Thomson parabola detected lead ions of 1 to 7 charges with high energy (several keV). Figure 3 shows the example of the time variation of mass number 27, 54 with Al traget. As the variation curves show almost same, the 54 amu particles are estimated to be dimer of Al.

In the fiscal year 2006, we plan to investigate time variation of emitted particles synchronized to laser pulse and identify the source of them (the chamber surface, plimary target, and secondary target), and also try to improve mesurement methode.

Acknowledgement

The authors appreciate Prof. Sakawa of Nagoya University for their supports on the experiments.

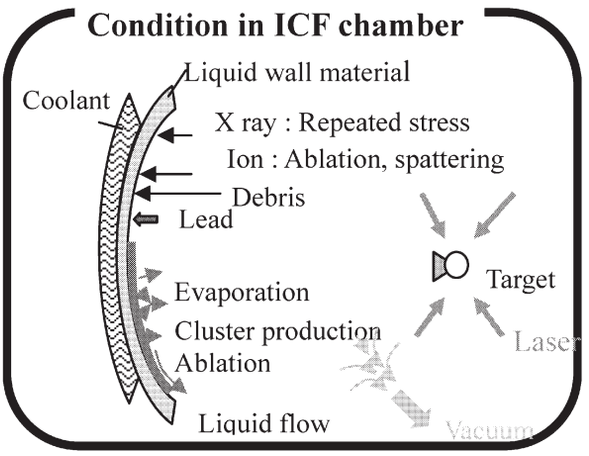

Fig. 1 Schematics of particle flow in ICF chamber

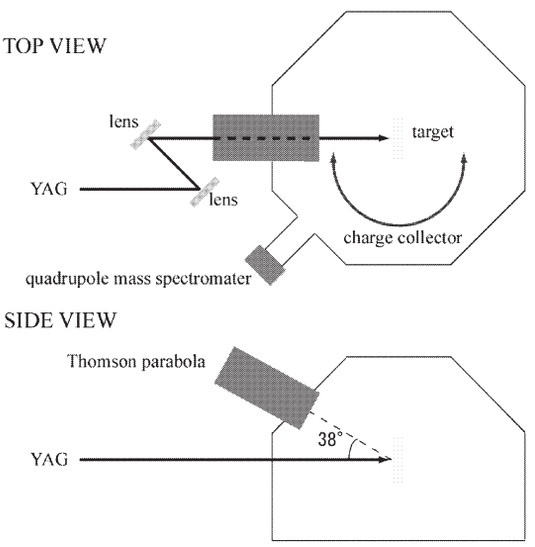

Fig.2 Experimental Apparatus

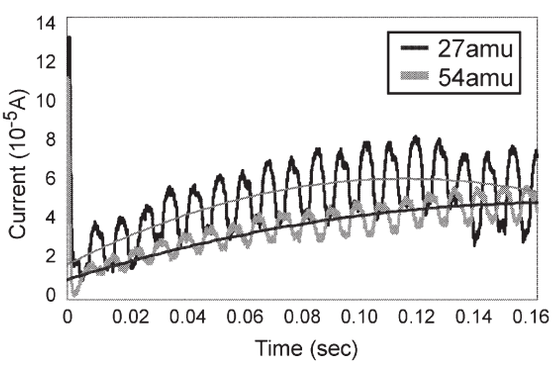

Fig.3 Time variation of 27, 54 amu with Al target