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ABLATION AND ITS PRODUCT OF THE FAST IGNITION INERTIAL CONFINEMENT FUSION REACTOR CHAMBER

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One of the major problems in the 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) which will be used as the material of the cone to be attached to the target fuel pellets adds specific material transfer issues such as deposited on the chamber wall, ablation, and formation of clusters that is suspected to affect the pumping characteristics. Ablated metal particles from the wall are suspected to form various sizes of clusters that flies slower and more difficult to evacuate. Also when liquid metal is used as chamber inner wall, generation and removal of the metallic vapor, cluster, and mist is not understood and may cause unpredictable problems. Therefore, it is necessary to investigate behavior of the chamber wall under simulated laser fusion condition by experiments as well as numerical studies.

In this study, preliminary experiment to simulate and study the target chamber wall is performed at the Institute of Laser Engineering, Osaka University. The YAG laser (2J, 10ns) irradiated on a plastic target, and the ablated particles are measured using the Thomson parabola, the charge particle collector, and the quadrupole mass spectrometer.

From these experiments,

- the carbon ions with one, two, and three charge state, and the hydrogen ion are observed in the Thomson parabola, and
- the mass peaks of 14n+1 and 14n+2 amu which are considered to be the fragments of polyethylene or cluster of monomers are observed by the quadrupole mass spectrometer.

In the present experiments, tin or lead metal target is also installed beside the plastic target in 45 degree angle. It is hit by ablated plastic particles and ablated to simulate the bombardment of the lead wall by debris in the chamber. Broad range of upto 2000 amu mass spectrometer is prepared to analyze the clusters of heavy metals.

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