§57. Development of Aluminum Cone Tip for Fast Ignition Experiment

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In fast ignition, the role of corn is very important to guide hot electrons to imploded core plasma for heating. Recently, many researchers have reported that hot electrons were diverged more than expected[1) 2)]. It is concerned that hot electrons are scattered by high-Z plasma generated from gold cone target[3)]. This may cause the drop of the energy coupling of the heating laser to hot electrons. Therefore, low-Z materials are drawing attention as cone materials. Moreover, some simulation studies suggest the possibility for the hot electron beam guiding by the self-generated magnetic field by using pointed type cone (Tongari cone). In this study, we develop the method to fabricate an aluminum cone tip to attach the conventional gold cone in order to confirm above mentioned interesting characteristics of the low Z cone. Figure 1 shows a target shape of an aluminum cone tip.

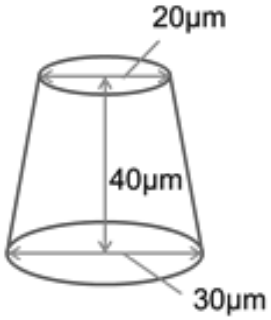

Fig. 1. A target shape of an aluminum cone tip.

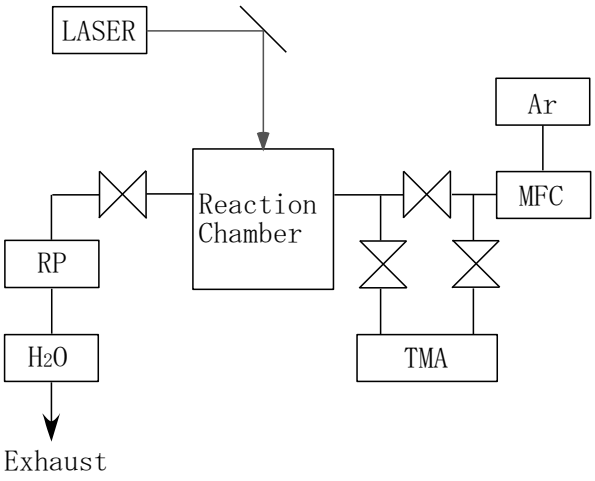

Fig. 2. A schematic diagram of a laser CVD system

A schematic diagram of laser CVD system is shown in Fig. 2. We use trimethylaluminum (TMA) as a chemical precursor of aluminum. Because of its explosive nature in the air, we depressurize the whole system under 1 kPa and use argon gas which contains TMA by bubbling as the reaction gas. This reaction gas is heated by heater set under substrate and a laser irradiation on the substrate. TMA is thermally decomposed when it is heated above 300 degrees and become aluminum. The deposits were observed by a digital zoom microscope.

We performed experiments with different laser irradiation time. The laser power was 10 mW and the spot size was 700 micron. The results are shown in Fig. 3. It is found that the height of a deposit are increased with laser irradiation time. However, it is decreased when laser irradiation time exceeds 60 seconds. The laser beam was focused on just before the substrate. Therefore, we think as follows. When a deposit grew with laser irradiation time, the top of a deposit came close to the laser focal point and ablated by the strong laser beam. System modification is needed to overcome this problem.

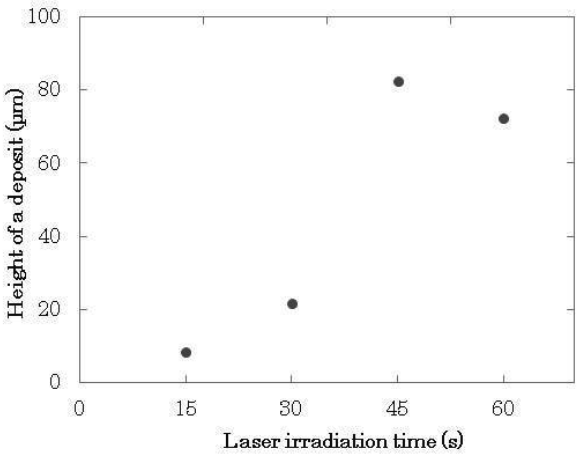

Fig. 3.Laser irradiation time dependence of the height of deposits.

1) Green, J. S. et al.: Phys. Rev. Lett., **100** (2008) 015003.
2) Akli, K. U. et al.: Phys. Rev. E **86** (2012) 026404.
3) Johzaki, T. et al.: Plasma Phys. Control. Fusion **51** (2009) 014002.