

## §42. Study on Stagnations of Plumes in Laser Fusion Liquid Wall Reactor Chamber

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A design of laser fusion reactor with a liquid wall, KOYO-fast, is reported in Refs. 1-3. Fig. 1 shows the simple outline of the first wall of KOYO-fast.

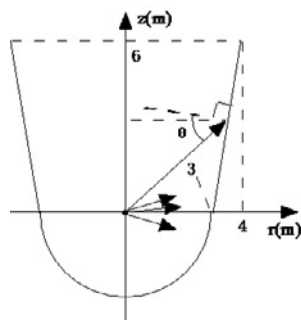


Fig. 1 The simple outline of the first wall of KOYO-fast.

To experimentally simulate the ablation process, laser irradiation is often used. We, however, found that ablation process by ions is quite different from that by lasers. The range of  $\alpha$  particles in liquid Pb is about 10  $\mu\text{m}$ . As the result, superficial liquid Pb evaporates as a high density, low temperature, plasma with low ionization rate. In this study, we have developed an integrated ablation simulation code DECORE ( Design Code for Reactor ) to clarify the ability of the chamber clearance.

Fig. 2 shows number density and velocity profiles of lead at the time a plume reaches to the center of the chamber. As shown in Fig. 2, ablated lead moves with velocities of roughly 40 km/s. To estimate number density and velocity is very important for analysis of collisions between plumes at the center of the chamber.

Fig. 3 shows diameters of clusters and condensation rate at the same time in Fig. 2. The regime  $x < 0.5\text{m}$ , clusters are created.

Collisions between plumes produced by ablation at the center of the liquid wall chamber are estimated. Collisions between plumes strongly affect a design of laser fusion reactor. Fig. 4 shows the time development of pressure distribution. Note that in Fig. 4, times from a collision starts are described. As shown in Fig. 4, at the time = 213 ms, near by the center of the chamber, pressure is roughly 10 Torr, and there is no aerosol at this time.

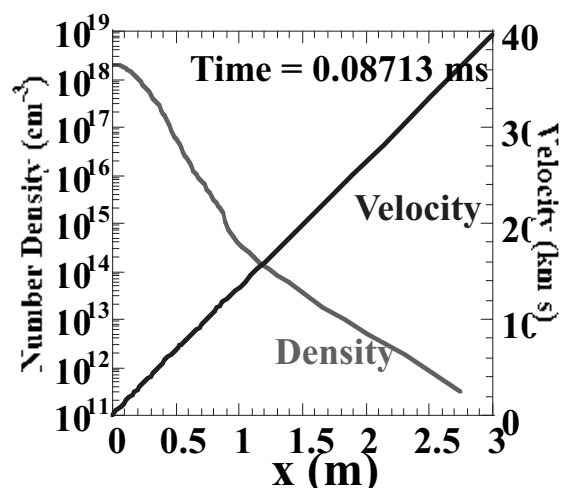


Fig. 2 Number density and velocity profiles of lead.

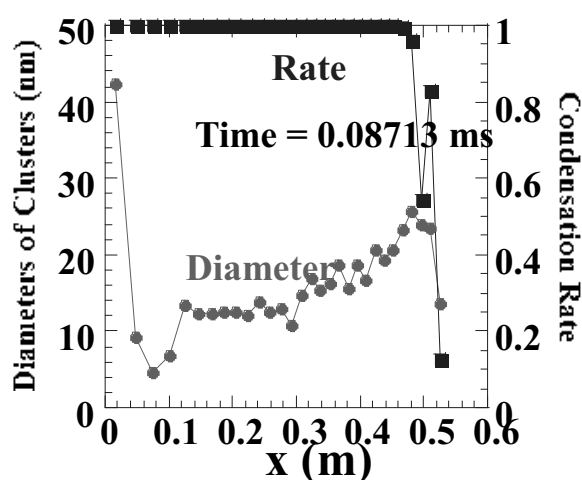


Fig. 3 Diameters of clusters and condensation rate.

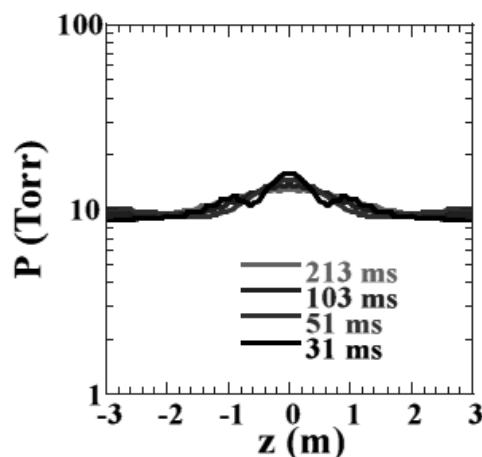


Fig. 4 Time development of pressure profiles.

- [1] Y. Kozaki, Fusion Science and Technology **49** (2006) 542-552.
- [2] Y. Kozaki et.al.; J. Plasma and Fusion Research **82** (2006) 817-837. (in Japanese)
- [3] Y. Kozaki et.al.; J. Plasma and Fusion Research **83** (2007) 3-29. (in Japanese)