Design of octahedral spherical hohlraum for CH Rev5 ignition capsule

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In this work, we design an octahedral spherical Au hohlraum for CH Rev5 ignition capsule [1] by using the initial design method and two-dimensional (2D) simulations, and we investigate its laser entrance hole (LEH) closure and laser-plasma instabilities (LPI) by using a spherical hohlraum with two different-size LEHs via 2D simulations. The designed spherical hohlraum with $R_H = 5\ R_C$, $R_L = 1.2$ mm, and $R_L* = 2R_L$ requires an ignition laser pulse of 1.92 MJ in energy and 670 TW in peak power, where R_H, R_C, R_L, and R_L* are radii of spherical hohlraum, capsule, LEH, and the cylindrical LEH outer ring, respectively.

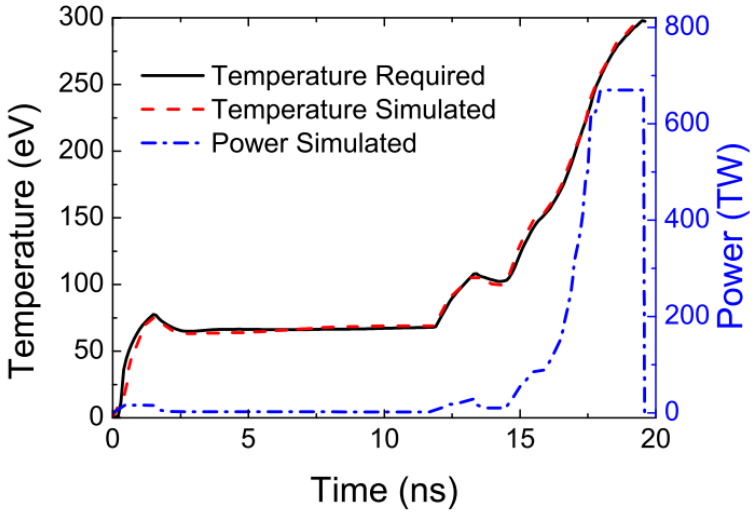

Fig. 1 Radiation temperature (dashed: required by the CH Rev5 capsule, solid: from 2D simulation) and laser power (dash-dotted) for the designed octahedral spherical hohlraum with $R_H = 5\ R_C$ and $R_L = 1.2$ mm.

From 2D simulations, the closure and opening up of LEH are clearly obtained. The LEH closure and its rate are strongly connected to the radiation pulse, while the LEH opening-up and its rate are strongly connected to the laser pulse. The smallest radius of LEH during closure is 0.6 mm before opening up, which leaves enough room for arranging the laser beams with a radius of 0.5 mm in our design. By using a post-process code for LPI, a relatively high stimulated Brillouin scattering fraction and a very low stimulated Raman scattering fraction are predicted, which may be due to the neglection of three-dimensional density gradients of the ablative flow along the laser transportation in 2D simulations.

This work provides the energy and power references for the future ignition laser facility which uses octahedral spherical hohlraums as ignition targets.

References

[1] S. Haan, et al., Phys. Plasmas 18, 051001 (2011)