Experiments of gold foam hohlraum on the SG-III prototype laser facility

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Time-dependent drive asymmetry is thought to make the significant contribution to implosion performance degradation in laser indirect driven inertial confinement fusion. Principal asymmetry source is SRS from the inner beams within the gas-filled hohlraums. However, the alternative hohlraum designs with lower gas fill pressures lead to drive asymmetry in the later phase of laser pulse, which is caused by plasma expanding from the hohlraum wall. It is necessary to find another method to achieve drive symmetry.A high Z metallic foam as hohlraum wall material will reduce hydrodynamic losses[1], which is caused by less kinetic energy loss[2]. Low density foam liner is predicted to have a higher conversion efficiency than solid hohlraum, and limit the wall blow-in and so could improve the drive symmetry[3].

The experiments about x-ray re-emission and plasma expansion of foam gold and solid gold are performed onSG-III prototype laser facility. The experimental results demonstrate for the first time that the x-ray re-emission from foamgold with a 0.3 g cc^{-1} density is increased compared to that from solid gold. Furthermore, the velocities of x-ray emission fronts moving off the wall are much smaller for foam gold with 0.3 g cc^{-1} density. And the experiments of cylindrical hohlraums have also been carried on. The results indicate that the emission fronts of ~420 eV and ＞2.5 keV in the foam hohlraums move less than that in the solid gold hohlraums. These experimental results are consistent with the simulation results. There are potential advantages to using foam walls for improving x-ray flux and limit the wall plasma expansion.

References

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