Experimental Investigation of the Capsule Engineering Features at High Convergence

L.A. Pickworth[1], B.A. Hammel[1], V.A. Smalyuk[1], H.F. Robey[1], A. MacPhee[1], H.A. Scott[1], M. Stadermann[1], S. Felker[1], J. Milovich[1], L.F. Berzak Hopkins[1], S. LePape[1]
[1]Lawrence Livermore National Laboratory, Livermore, CA, USA
pickworth1@llnl.gov

To support the capsule in the ICF hohlraum and fill the capsule with gas we use some engineering mechanisms. A 45 nm plastic film, which we term the 'tent', holds the capsule in the middle of the hohlraum. A 10 μm SiO_2 tube, that is glued into a hole in the capsule allowing it to be filled with gas, we term the 'fill tube'. As the capsule is accelerated inward, a perturbation can grow during the initial shock-transit phase and then be amplified by the Rayleigh-Taylor instability. The tent and fill tube can seed such hydrodynamic perturbations. This can lead to both ρR perturbations, resulting in poor compression, and mix of ablator material into the hotspot. We set out to characterize these engineering features experimentally.

Measurements of ρR perturbations near peak implosion velocity (PV) are essential to our understanding because they reflect the integrity of the capsule, after the inward acceleration growth is complete, of the actual shell perturbations. To address this we have developed two experimental techniques at the National Ignition Facility to measure the effect of the tent and the fill tube between peak velocity and peak compression of the capsule. The first uses the self emission from the forming hot-spot to "self radiograph" the shell, allowing a measurement of the shell integrity near peak velocity. The second uses preferential doping of the inner surface of the shell to highlight the penetration of the jets resulting from ablation front perturbations into the forming hot-spot near to peak compression. These experimental techniques take advantage of the new Kirkpatrick-Baez Microscope which gives 6 μm spatial resolution with a 3 keV bandwidth energy response centered at 10.3 keV.

This talk will present the results from 'self-backlighter' experiments, measuring growth from a tent at radii < 200 μm as driven by a low-adiabat laser pulse shape in a CH ablator. We will also present the first experimental results from preferential doping of the inner surface of a high-density carbon (HDC) capsule with W, highlighting features from the tent and fill tube.

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