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For ICF hohlraums driven by long pulses, such as will be needed for ignition on the NIF, the high-Z wall must be held back to avoid excessive laser spot motion and time-dependent symmetry swings. One means of accomplishing this is to fill the hohlraum with a low density, low-Z gas. We report on gas-wall interface characterization by axial x-ray backlighting and self-emission, on gas filled hohlraums fielded at the Omega facility. Up to 30 drive beams are fired, forming a single ring of illumination on the hohlraum wall to emulate the near 2D cylindrically symmetric NIF hohlraum drive conditions. We compare the observed motion with predictions. In addition, the gas-gold interface is Rayleigh-Taylor (R-T) unstable during deceleration. This R-T instability could be further exacerbated in NIF ignition hohlraums designed with intentionally roughened walls to provide smoothing of infrared heating used to prepare smooth DT ice layers in the capsule. We have therefore intentionally prepared initial perturbations on one half of the gold wall to quantify the amount of increased penetration, due to mix of the gold into the gas, at stagnation.

Cryogenic capsules for indirect drive ICF may use infrared heating (IR) to produce smooth layers. This technique requires a roughened hohlraum wall, to adequately smooth the IR light. A roughened hohlraum wall, in turn, will be Rayleigh-Taylor unstable if it is decelerated by an internal gas, designed to prevent significant wall motion.

We have performed an experiment at the Omega laser [ref 1] to examine this effect. Thirty, 1 ns long, Omega beams were used to illuminate a 1600 um diameter, 1200um long, gas-filled (but no capsule) hohlraum. Five additional beams were delayed by 1.3 ns, and used to illuminate an axial x-ray backlighter made of vanadium, scandium, or titanium. The hohlraum was manufactured with half of its interior wall deliberately roughened to 4 um rms. The axial x-ray backlighter was arranged so that it would illuminate one-quarter of the hohlraum, in azmuth, where the wall was smooth, and one-quarter where it was roughened. The remaining half of the hohlraum was not illuminated by the backlighting x-rays, so that any self-emission from the gold wall could be observed. The back-lighting was delayed until after the drive beams were off.

The hohlraums were filled with neopentane gas to produce two different fill densities; 1 and 2 mg/cc. The slightly more energetic vanadium He-like x-rays were used as a backlighter for the 1 mg/cc case; titanium and scandium He-like lines were used for the higher fills.

The Dante soft x-ray power diagnostic was used to measure radiated flux. The geometry was such that the diagnostic was dominated by radiation from one side of the hohlraum. Since the diagnostic is fixed, the targets were varied, with the dante seeing predominantly (82%) a rough wall on some shots, and a smooth wall on others.

One small experimental detail is that the multi-image x-ray framing camera records each image at a slightly different angle, with up to a 3 degree offset from the hohlraum axis. Each image had to be analyzed to remove this parallax. The uncertainty due to this is approximately 50 um in the calculated radius.

The results of this first experiment can be summarized as follows. We observed no difference in the backlit images, between the roughened and smooth walls. Nor did we detect any differences in their soft x-ray flux. Contrary to pre-shot simulations, there was no detectable (that is, comparable to the backlighter emission) emission from the gold walls. The wall appears to stagnate at a slightly larger radius than initially predicted. Finally, we had hoped to see a small 'shelf' of gold, as predicted. Instead, the backlight images move smoothly from opaque to transmitting over a distance larger than the experimental resolution. While this may be due to gas-wall mix (in both smooth and rough cases), it may also be due to end-effects, since the measurement is a line-integral one.