A comparison of the hydrodynamic instabilities in CH, HDC, and Beryllium ablators on NIF

V. A. Smalyuk[1], H. F. Robey[1], S. Ali[1], L. F. Berzak Hopkins[1], S. Bhandarkar[1], D. T. Casey[1], P. M. Celliers[1], D. S. Clark[1], J. Crippen[2], M. Farrell[2], S. J. Felker[1], J. E. Field[1], E. Giraldez[2], S. W. Haan[1], B. A. Hammel[1], W. W. Hsing[1], J. Kline[3], J. J. Kroll[1], O. L. Landen[1], S. LePape[1], E. Loomis[3], A. MacPhee[1], D. Martinez[1], J. Milovich[1], A. Moore[1], A. Nikroo[1], L. Pickworth[1], N. Rice[2], M. Stadermann[1], C. R. Weber[1], S. V. Weber[1], and A. Yi[3]

[1]Lawrence Livermore National Laboratory, Livermore, CA 94550

[2]General Atomics, San Diego, CA

[3]Los Alamos National Laboratory, Los Alamos, NM 87545

Email: smalyuk2@llnl.gov

The mission of the capsule Ignition Science Campaign is to develop a greater understanding of capsule physics in ICF implosions, primarily effects of hydrodynamic instabilities on implosion performance, and to develop techniques to mitigate these instabilities. A comparison of the hydrodynamic growth in plastic (CH), high-density carbon (HDC), and beryllium ablators will be presented in indirect-drive implosions on National Ignition Facility (NIF). This comparison is based on experimentally measured instabilities in all phases of implosions for the three ablators. In the acceleration phase of implosions, instability growth at the ablation-surface was measured with the Hydrodynamic Growth Radiography (HGR) platform on NIF. The HGR measurements using pre-imposed 2-D modulations were used to compare instability dispersion curves for the three ablators at convergences up to ~2x. The 3-D "native roughness" perturbations and engineering features including fill tubes and capsule support membranes ("tents") were measured for convergences up to ~3x using 3-D HGR platform and were compared for the three ablators. Measurements showing unexpected perturbations, possibly generated due to oxygen up-take during target assembly, will be shown. Rippled-shock measurements with 2-D VISAR on the OMEGA laser were used to measure 3-D perturbations from the ablator surface and bulk of the ablator during the initial Richtmyer-Meshkov phase of the drive.

In the deceleration phase of implosions, an innovative method was developed to use the self-emission from the hot spot to "self-backlight" the shell in-flight. In another technique, emission from high-Z capsule dopants were used to visualize perturbations and asymmetries around peak compression. The results of the 3-D perturbation growth including engineering features will also be presented for convergence from ~5 to ~20 and compared for the three ablators.

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