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I3.201 Review of hydrodynamic instability experiments in ICF implosions on National Ignition Facility

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In Inertial Confinement Fusion (ICF), an indirectly driven implosion begins with an acceleration phase when the hohlraum x-rays ablate the shell surface and the capsule starts to converge. At this stage, outer-shell non-uniformities grow due to the acceleration-phase Richtmyer-Meshkov (RM) and Rayleigh≠Taylor (RT) instabilities. As the shell accelerates, these front-surface perturbations feed through the shell, seeding perturbations on the ablatorice and ice-gas interfaces. During the deceleration phase, the inner surface of the shell is subject to RT instability.
Several new platforms have been developed to experimentally measure hydrodynamic instabilities in all phases of implosions on NIF. At the ablation front, instability growth of preimposed modulations was measured with face-on x-ray radiography platform in the linear regime using the Hydrodynamic Growth Radiography (HGR). In addition, modulation growth of 3-D "native roughness" modulations was measured in conditions similar to those in layered DT implosions.
A new experimental platform was developed to measure instability growth at the ablator-ice interface. 2-D modulations were laser-imposed at the inner surface of the plastic capsule for implosions with DT layers to probe stability of the ablator-ice interface using xray radiography with this new Layered Hydrodynamic Growth Radiography (LHGR) platform.
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. Capsules used argon dopant in the gas to enhance x-ray emission at the beginning of the deceleration phase that serves as a "backlighter" to image growing shell modulations. In addition, atomic mix between plastic shell and a gas was studied at peak compression using plastic "Symcap" shells filled with tritium gas and imbedding localized CD diagnostic layer in various locations in the ablator. Experimental results from all these campaigns will be reviewed.

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