The Evolution of Surface Defects Driven by Shock Waves

Drive

Shock reflectivity

Time

Space

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Summary

The evolution of submicron surface defects was observed in planar targets using optical diagnostics

- Shell uniformity is critical to performance of inertial confinement fusion (ICF) implosions*
- Defects on the outer surface alter shock-wave propagation, creating nonradial velocities that alter mass distribution
- The effects of 0.5- to 5-μm high × ~50-μm glue dots are readily observed
- Cryogenic and spherical experiments are planned

Will use this technique to validate simulations of debris on targets.

*T. C. Sangster, NI2.00002, this conference.
Collaborators

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Shock waves are observed optically using time-resolved VISAR* and SOP**

* Velocity interferometer system for any reflector
** Streaked optical pyrometer

Shocks are reflective and emit light.
The effect of surface defects are observed using a probe beam reflected from the modulated shocks.
Shock-front curvature affects the VISAR intensity

Return beam can be defocused or steered

Local normal
A spherical surface defect produces shock modulations at both its center and edges.
Multiple shock waves can exacerbate the effects of surface defects

*I. V. Igumenshev, NO4.00002, this conference.*
A simple analysis using shock curvature predicts two features in reflected signal.
Simulations predict different behavior for multishock experiments

- Convergent (inner) and divergent (outer) features
- Second shock causes convergence of outer feature
Simulations show qualitative agreement with both single and multishock experiments.

Features caused by shock curvature

- Single shock
- Multiple shock

- Delayed breakout

- CH 40 µm

- ~5.0-µm glue dots
Reflection and self-emission both show effects of multiple shocks in ejected material.

Can observe effects of $<1\mu m$ high $\times \sim 50\mu m$ dots!
Summary/Conclusions

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