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Two-dimensional effects on shock planarity in confined laser ablation ERIC LOOMIS, LANL, DAMIAN SWIFT, LLNL, SHENGNIAN LUO, LANL

— The ablation of solid material when illuminated with focused laser pulses is a common method for driving strong shocks into the target material and is typically treated as one-dimensional. The expansion and blow-off of the low-density, high-temperature coronal plasma has, however, non-axial flow components. In laser shock experiments, the plasma can be confined by a transparent substrate resulting in higher pressures and longer duration shock waves in the solid material for moderate laser energies. In an effort to understand the loading history and shock planarity in these targets to greater accuracy, numerical simulations have been carried out and compared to experimental velocity profiles. Two-dimensional continuum mechanics simulations have been carried out using high-temperature equations-of-state for C and Al. The laser energy is deposited into a thin layer of C or Al at the interface between a sapphire substrate and target material (Be) in a simplified manner without rigorously accounting for realistic laser-matter interactions. Variations in total energy and irradiance history on the loading are included in the study. Simulations are compared to one-dimensional radiation hydrodynamics calculations and possible improvements to the confined ablation target design are given.

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