SAND2014-2035C

Reactive Foil Ignition by Pulsed Laser Irradiation

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It has been shown that forced mixing of reactive layers (foils) leads to an exothermic release of energy after initiation of mixing by forced impact or pulsed laser irradiation. In order to understand the ignition of foils initiated by laser irradiation, we study the interaction of laser pulses with Al/Pt multilayer reactive foils prepared by sputter deposition. It will be shown that the single-pulse ignition threshold is dependent on the length of the laser pulse as the pulse length is varied from 100 fs to 100 ms. The dependence of the ignition threshold on pulse length is a combination of laser-material interactions such as the size of the heat affected zone, changes in reflectivity with pulse length, and the onset of ablation for ultrafast irradiation. The laser spot size is varied for each pulse length to explore the effects of heat confinement on the ignition threshold. Foil ignition kinetics is further investigated by varying the bilayer thickness for each pulse length, which subsequently changes properties such as mixing and reaction front velocity.

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