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Generation of isentropic compression by use of multi-layer composite flyer and its influence on system thermodynamics: A simulation study ADITI RAY, Bhabha Atomic Research Centre, Mumbai, India — Recently the possibility of achieving quasi-isentropic compression using functionally graded materials, in both gas gun and explosive driven systems was explored by hydrodynamic simulations. In the current paper, we show that multi-layered composite flyer with progressively increasing shock impedances, referred to as graded density impactor (GDI), has the potential to enable increased flexibility in suitably tailoring applied-pressure profiles, further relaxing constraints on the thermodynamic path of compressed material. Present simulation pertaining to constant velocity impact of GDI reveals that linear ramp pulses of different pressure rise times with comparable peak pressures can be realized only by changing the layer thicknesses of a particular GDI. We report generation of three different slope ramp pulses by a five layer GDI made of PMMA, Al, Ti, Cu and Ta with different set of optimum thicknesses obtained with genetic algorithm based optimization technique. Generation of long duration ($\sim \mu$s) isentropic pressures using discrete GDI is a significant step, since it is devoid of fabrication difficulties of ultra-thin lamellae of FGM. Signatures of isentropic compression of a thin Cu target under different slope ramp loadings are identified from basic thermodynamic aspects in terms of temperature rise and entropy production. It is shown that the extent of entropy increase is closely related to the slope of ramping pulse. Further, a physical model has been constructed to determine the approximate time profile of pressure pulse generated by equal layer-width GDI.

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