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Damage in Low Alloy Steel Produced by Sweeping, Interacting Detonation Waves LAWRENCE HULL, GEORGE GRAY, JAMES FAULKNER, MATTHEW BRIGGS, Los Alamos National Laboratory — Detonation waves that sweep along the surface of a metal plate induce reduced pressure and enhanced shear, relative to the same detonation at normal incidence. Detonation waves at intermediate obliquity impress intermediate combined stress states. Release waves from the free surfaces may enter into play and contribute to the damage. Initiation of explosive at discrete points produces strong pressure, density, and velocity gradients in the gaseous explosive products where the waves collide that are impressed in an adjacent metal, causing similar stress gradients within the metal that often cause intense damage. In this work, we investigate damage generated in AISI 4130 steel by the combined effects of oblique drive and interacting detonation waves. The experimental data consists of multipoint velocimetry points probing the free surface in regions loaded by interacting detonation waves and regions between the interactions. Metallography on recovered plate records the plastic flow and damage correlated with the velocimetry data. Calculations provide further insight into the loading conditions created by the sweeping, interacting detonation waves. Spall is indicated in most regions, but not some, and the alpha-epsilon stress-induced phase transformation appears in most regions, but not all. Correlations of the observed physical effects with incident wave obliquity and transverse position relative to the wave interactions are discussed.

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