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Equations of state of detonation products: ammonia and methane
JOHN LANG, DANA DATTELBAUM, PETER GOODWIN, DANIEL GARCIA, JOSHUA COE, JEFFERY LEIDING, LLOYD GIBSON, BRIAN BARTRAM, Los Alamos Natl Lab — Ammonia (NH_3) and methane (CH_4) are two principal product gases resulting from explosives detonation, and the decomposition of other organic materials under shockwave loading (such as foams). Accurate thermodynamic descriptions of these gases are important for understanding the detonation performance of high explosives. However, shock compression data often do not exist for molecular species in the dense gas phase, and are limited in the fluid phase. Here, we present equation of state measurements of elevated initial density ammonia and methane gases dynamically compressed in gas-gun driven plate impact experiments. Pressure and density of the shocked gases on the principal Hugoniot were determined from direct particle velocity and shock wave velocity measurements recorded using optical velocimetry (Photonic Doppler velocimetry (PDV) and VISAR (velocity interferometer system for any reflector)). Streak spectroscopy and 5-color pyrometry were further used to measure the emission from the shocked gases, from which the temperatures of the shocked gases were estimated. Up to 0.07 GPa, ammonia was not observed to ionize, with temperature remaining below 7000K. These results provide quantitative measurements of the Hugoniot locus for improving equations of state models of detonation products.

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