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Hugoniot Properties of Explosives Forming Multi-Phase Condensed Species LEONARD STIEL, NYU Tandon School of Engineering (Retired), PHILIP SAMUELS, US ARMY FUTURES COMMAND, Picatinny Arsenal — Analyses are conducted with the Jaguar thermochemical equilibrium program on the Hugoniot behavior of explosives which form multi-phase condensed species upon detonation, including carbon and aluminum, for wide ranges of temperatures and pressures. For carbon-forming explosives such as TNT, recently developed multi-phase property relationships with modified phase equilibrium behavior are utilized in the analyses. It is shown that discontinuities occur in the predicted Hugoniot curves because of the exhibited phase transitions. As noted previously, calculated shock velocities on the Hugoniots of carbon-forming explosives can exhibit double minima with respect to volume at which either, but not both, of the usual C-J point criteria that the detonation velocity is a minimum and the mass velocity is equal to the speed of sound are satisfied. At these conditions, the overall shock velocity minimum occurs at a limiting carbon phase transition point. With the sonic condition state considered as the C-J point, the other minimum point is on the overdriven Hugoniot with speeds of sound discontinuous and with shock velocities in this region lower than the C-J value. The indicated behavior is investigated by comparisons with experimental overdriven Hugoniot data, C-J velocities, sound speeds, and with cylinder test data using appropriate JWL relationships.

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