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Improved Relationships for the Thermodynamic Properties of Carbon Phases at Detonation Conditions LEONARD STIEL, Polytechnic Institute of NYU (Retired), ERNEST BAKER, DANIEL MURPHY, U.S. Army ARDEC Picatinny Arsenal — In order to improve the procedures utilized in the Jaguar thermochemical program for carbon, volumetric and heat capacity relationships have been developed for graphite, diamond, and liquid carbon forms. Available experimental thermodynamic property and Hugoniot data have been analyzed to establish optimum equations of state for the carbon phases. The appropriate carbon form or multiple forms at equilibrium results from the minimization of the Gibbs free energy of the system. The resulting relationships are utilized to examine the phase behavior of carbon at elevated temperatures and pressures. The behavior of metastable carbon states is optimized by analyses of Hugoniot data for hydrocarbons, and C-J and cylinder velocities for a database of CHNO explosives. The accuracy of the resulting relationships is demonstrated by comparisons for several properties, including the Hugoniot behavior of oxygen-deficient explosives at overdriven conditions.

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