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Shock Compression of Formic Acid VIRGINIA MANNER, STEPHEN SHEFFIELD, DANA DATTELBAUM, RAY ENGELKE, DAVID STAHL, Los Alamos National Laboratory, SHOCK AND DETONATION PHYSICS TEAM —
Simple molecules such as formic acid, HCOOH, have been suggested to play important roles in the origin of life due to their high pressure and temperature chemistry. The hydrogen bonding characteristics and polymerization of HCOOH under high pressure have been recently investigated using both molecular dynamics calculations and experimental work. These works suggest that symmetric hydrogen bonding of HCOOH (forming a linear chain polymer where all C-O bonds are equivalent) occurs at 16 - 21 GPa at room temperature. In order to examine the shock compression behavior of this simple carboxylic acid, we present a series of gas gun-driven plate impact experiments on formic acid with shock inputs in the range of 10 - 20 GPa, overlapping in pressure with the earlier static experimental results. Using in-situ electromagnetic gauges, shock wave profiles (particle velocities) were measured at multiple Lagrangian positions as a function of shock input pressure, providing valuable information about its unreacted equation of state and shock-induced chemical reactions. The results are discussed in the context of the Hugoniot conditions, phase diagram and static high-pressure behavior, and related chemistry of other simple hydroxyl-/carboxyl-containing molecules.

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