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Shock Initiation and Equation of State of Ammonium Nitrate DAVID ROBBINS, STEVE SHEFFIELD, DANA DATTELBAUM, RAJA CHELLAPPA, NENAD VELISAVLJEVIC, Los Alamos National Laboratory — Ammonium nitrate (AN) is a widely used fertilizer and mining explosive commonly found in ammonium nitrate-fuel oil. Neat AN is a non-ideal explosive with measured detonation velocities approaching 4 km/s. Previously, we reported a thermodynamically-complete equation of state for AN based on its maximum density, and showed that near-full density AN did not initiate when subjected to shock input conditions up to 22 GPa. In this work, we extend these initial results, by presenting new Hugoniot data for intermediate density neat AN obtained from gas gun-driven plate impact experiments. AN at densities from 1.8 to 1.5 g/cm3 were impacted into LiF windows using a two-stage light gas gun. Dual VISARs were used to measure the interfacial particle velocity wave profile as a function of time following impact. The new Hugoniot data, in addition to updates to thermodynamic parameters derived from structural analysis and vibrational spectroscopy measurements in high pressure diamond anvil cell experiments, are used to refine the unreacted EOS for AN. Furthermore, shock initiation of neat AN was observed as the initial porosity increased (density decreased). Insights into the relationship(s) between initial density and shock initiation sensitivity are also presented, from evidence of shock initiation in the particle velocity profiles obtained for the lower density AN samples.

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