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Temperature and Pressure from Collapsing Pores in HMX[1] D. BARRETT HARDIN, Air Force Research Lab, Munitions Directorate, Ordnance Division, Energetic Materials Branch — The thermal and mechanical response of collapsing voids in HMX is analyzed. In this work, the focus is simulating the temperature and pressure fields arising from isolated, idealized pores as they collapse in the presence of a shock. HMX slabs are numerically generated which contain a single pore, isolated from the boundaries to remove all wave reflections. In order to understand the primary pore characteristics leading to temperature rise, a series of 2D, plane strain simulations are conducted on HMX slabs containing both cylindrical and elliptical pores of constant size equal to the area of a circular pore with a 1 micron diameter. Each of these pore types is then subjected to shock pressures ranging from a weak shock that is unable to fully collapse the pore to a strong shock which overwhelms the tendency for localization. Results indicate that as shock strength increases, pore collapse phenomenology for a cylindrical pore transitions from a mode dominated by localized melt cracking to an idealized hydrodynamic pore collapse. For the case of elliptical pores, the orientation causing maximum temperature and pressure rise is found. The relative heating in elliptical pores is then quantified as a function of pore orientation and aspect ratio for a pore of a given area.

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