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Improved Polymer Equations of State KATIE MAERZKE, JOSHUA COE, J. TINKA GAMMEL, Los Alamos National Laboratory — Polymers are pervasive in the modern world. They are used in a wide variety of applications for such tasks as structural support, impact mitigation, and maintenance of engineering tolerances. Yet polymer equations of state are the most underdeveloped of any material class. Polymers pose several unique modeling challenges. Like high explosives, they react and chemically decompose under sufficiently strong shock compression. We model this using two equations of state, one of the unreacted material and one for the decomposition products. Unlike high explosives, polymers typically exhibit a reduction (rather than increase) in volume upon reaction. Moreover, the molecular structure of polymeric materials results in thermal and shock compression properties that are different from metallic solids. Modeling these behaviors requires more sophisticated physics models. Polymer foams introduce additional complications, such as compaction and an "anomalous" volume expansion upon reaction. These modeling challenges will be discussed in the context of recent equations of state for polyethylene and a poly(dimethylsiloxane)-based foam.

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