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Grain-size effects in the shock heating of idealized PBXs NISHA MOHAN, MARC J. CAWKWELL, FRANK L. ADDESSIO, KYLE J. RAMOS, D.J. LUSCHER, Los Alamos National Laboratory — Polycrystalline microstructure and material anisotropy in plastic bonded explosives (PBXs) lead to thermal localization even under sub-shock impacts. We performed a systematic study of how grain size affects temperature in model PBX using finite element simulations. The modeling framework combines a dislocation-based, anisotropic, single crystal plasticity model with a visco-elastic constitutive model for estane. Our simulations used constant binder thickness or volume as the grain size was varied in the range of 25 to 300 microns. In the set of PBX simulations with constant binder thickness, smaller grains gave rise to lower average temperatures. Dispersion of the shock wave occurs rapidly in smaller grain simulations because of the greater volume fraction of binder. This led to a more uniform strain rate and temperature distribution with run distance of the shock wave into PBX. A shock dispersion effect explained variance and localization of temperatures in larger grains. We also examined anisotropy, binder thickness, microstructural stress concentrators, and shock front width to grain size ratio as other contributors in simulations of smaller grain PBXs.

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