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Numerical simulation of interaction of hypervelocity particle stream with a target ILYA LOMOV, BENJAMIN LIU, VLAD GEORGEVICH, TARABAY ANTOUN, LLNL — We present results of direct numerical simulations of impact of hypervelocity particle stream with a target. The stream of interest consists of submillimeter (30-300 micron) brittle ceramic particles. Current supercomputer capabilities make it possible to simulate a realistic size of streams (up to 20 mm in diameter and 500 mm in length) while resolving each particle individually. Such simulations make possible to study the damage of the target from synergistic effects of individual impacts. In our research we fixed the velocity distribution along the axis of the stream (1-4 km/s) and volume fraction of the solid material (1-10%) and study effects of particle size variation, particle and target material properties and surrounding air properties. We ran 3D calibration simulations with up to 10 million individual particles and conducted sensitivity studies with 2D cylindrically symmetric simulations. We used an Eulerian Godunov hydrocode with adaptive mesh refinement. The particles, target material and air are represented with volume-of-fluid approach. Brittle particle and target material has been simulated with pressure-dependent yield strength and Steinberg model has been used for metal targets. Simulations demonstrated penetration depth and a hole diameter similar to experimental observations and can explain the influence of parameters of the stream on the character of the penetration.

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