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Mesoscale simulations of powder compaction ILYA LOMOV, TARABAY ANTOUN, BENJAMIN LIU, LLNL — Mesoscale 3D simulations of metal and ceramic powder compaction in shock waves have been performed with an Eulerian hydrocode GEODYN. The approach was validated by simulating shock compaction of porous well-characterized ductile metal using Steinberg material model. Results of the simulations with handbook values for parameters of solid 2024 aluminum have good agreement with experimental compaction curves and wave profiles. Brittle ceramic materials are not so well studied as metals, so material model for ceramic (tungsten carbide) has been fitted to shock compression experiments of non-porous samples and further calibrated to experimental match compaction curves. Direct simulations of gas gun experiments with ceramic powder have been performed and showed good agreement with experimental data. Numerical shock wave profile has same character and thickness as measured with VISAR. Numerical results show evidence of hard-to-explain reshock states above the single-shock Hugoniot line, which have also been observed in the experiments. We found that to receive good quantitative agreement with experiment it is essential to perform 3D simulations, since 2D results tend to underpredict stress levels for high-porosity powders regardless of material properties. We developed a process to extract macroscale information for the simulation which can be directly used in calibration of continuum model for heterogeneous media.

Ilya Lomov
LLNL

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