

Abstract Submitted
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On the applicability of analytical models to predict Hugoniot of nano-sized powder compacts.¹ CHENGDA DAI, DANIEL EAKINS, NARESH THADHANI, Georgia Tech, HSRLAB TEAM — Hugoniot of nano-sized powder pre-pressed to varied porosities is crucial for design of shock compaction experiments to fabricate bulk consolidated nanostructured compacts and for validation of the equation of state over a wide range of density and temperature. The McQueen and Wu-Jing models are representatives of isochoric and isobaric approaches to predicting porous Hugoniot. Both models, however, neglect the difference in internal energy between the powder compact and solid. Hence, it is uncertain if the models can still be applied to predict the Hugoniot of nanoparticle compact due to the high specific surface energy of nanoparticles relevant to specific internal energy. In the present work, we review the two models, focusing on their main assumptions and resultant restrictions, and show the increasing deviation of the predicted Hugoniot with increasing porosity from the available experimental data. We have also used piezoelectric stress gages to measure the Hugoniot of 25nm-Fe powder pre-pressed to 35% and 45% solid density. Experimental data show that the measured Hugoniot data are not fully consistent with the predicted results. Both models may be improved to predict Hugoniot of nanoparticle compacts by considering the characteristic properties of nano-sized particles.

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