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Meso-scopic Densification in Brittle Granular Materials[1]
WILLIAM NEAL, Applied Modelling and Computational Group, Imperial College London, GARETH APPLEBY-THOMAS, Dynamic Response Group, Cranfield University, GARETH COLLINS, Applied Modelling and Computational Group, Imperial College London — Particulate materials are ideally suited to shock absorbing applications due to the large amounts of energy required to deform their inherently complex meso-structure. Significant effort is being made to improve macro-scale material models to represent these atypical materials. On the long road towards achieving this capability, an important milestone would be to understand how particle densification mechanisms are affected by loading rate. In brittle particulate materials, the majority of densification is caused by particle fracture. Macro-scale quasi-static and dynamic compaction curves have been measured that show good qualitative agreement. There are, however, some differences that appear to be dependent on the loading rate that require further investigation. This study aims to investigate the difference in grain-fracture behavior between the quasi-static and shock loading response of brittle glass microsphere beds using a combination of quasi-static and dynamic loading techniques. Results from pressure-density measurements, sample recovery, and meso-scale hydrocode models (iSALE, an in-house simulation package) are discussed to explain the differences in particle densification mechanisms between the two loading rate regimes.

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