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Effect of Mesostructure and Fragmentation on Planar Shock Response of Dry Sand[1] SUNIL DWIVEDI, School of Materials Science and Engineering (Former), BENJAMIN HATANPAA, KIJANA EFFS, School of Materials Science and Engineering, BRIAN FERRI, School of Mechanical Engineering, NARESH THADHANI, School of Materials Science and Engineering, Georgia Institute of Technology, Atlanta, GA 30332 — The objective of the present work is to gain insight into the role of grain arrangements (mesostructure) and fragmentation on the shock response of dry sand under planar plate impact loading. Mesoscale simulations of the dry sand sample were carried out for initial porosities of 20% and 30% using CUBIT, LS-DYNA, and TECPLOT software. The mesostructure was varied as ordered (grains with edge contacts) and disordered (grains with point contacts) for the same porosity. The grain fragmentation was modeled by erosion method with erosion parameter of 0.5 and 0.75. The results show that computed Us-Up slope for 20% porosity with ordered mesostructure is negative at lower impact velocities and changes to positive when velocity is increased. However, the disordered mesostructure yields positive Us-Up slope at 20% porosity irrespective of the impact velocity. The Us-Up slope for 30% porous sand is positive irrespective of the mesostructure and impact velocity. More importantly, allowing grain fragmentation, the in-situ average longitudinal stress reduces from the computed Hugoniot stress by more than 25%. These results suggest the need for detailed simulations with varying mesostructure and more realistic fragmentation model as well experiments for a dry sand sample at lower porosities.

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