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Hugoniot Measurements on Dry and Water-Saturated Soils[1]
MATTHEW NEWMAN, California Institute of Technology, SARAH STEWART, University of California, Davis, RICHARD KRAUS, Lawrence Livermore National Laboratory — To better understand the shock properties of granular materials, we present a series of shock Hugoniot experiments on three types of soil in both dry and water-saturated states. We measured the shock states induced via planar impact experiments on the Harvard 40-mm gas gun. Shock wave velocities in the soils were measured using both VISAR and piezo-pins. The soils were composed primarily of quartz with different mass fractions of phyllosilicates and amorphous material. Using initial particle sizes ranging from 150 to 300 microns, the samples were pressed to densities ranging from 1.89 to 1.93 g cm^{-3} (about 25% porous). Water-sat samples had densities ranging from 2.2 to 2.6 g cm^{-3}. We find that the dry soils have a linear $U_s - u_p$ relation that is similar to dry quartz sand with the same initial density. The water-sat samples are less compressible and have much greater scatter in shock velocities. The VISAR measurement records the dispersion around the mean shock state that arises from reflections between grains, and we compare the VISAR data to meso-scale hydrocode simulations. These data will be used to generate more accurate rheological models for hydrocode simulations of the shock response of heterogeneous granular materials in the low-pressure regime (< 10 GPa).

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