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Correlating Computationally Derived Particle Surface Stress-Strain States to Mesoscale Shock Response[1] DAVID SCRIPKA, SUNIL DWIVEDI, NARESH THADHANI, School of Materials Science and Engineering, Georgia Institute of Technology, Atlanta, GA 30332 — The results of 2D and 3D FE simulations are presented, correlating the in-situ mesoscale shock response at the particle level to their surface observable stresses-strains for possible future experimental measurements. The ongoing work is an attempt to address a yet unresolved question; how a complex non-uniaxial thermomechanical shock response at the mesoscale, which may be a precursor to more complex phenomena, correlates to the average continuum uniaxial shock response. The objective of this work is to gain insight into how the complex responses at the meso/sub-mesoscale manifest to quantities that could be experimentally measured without perturbing the material. The simulations consider a 60 micron spherical sand particle mounted with a 1.8 micron thick epoxy coupon impacted by a 60 micron aluminum ball at 500 m/s. The impact is considered for the particle alone (direct impact) as well as embedded within an ensemble of 100 particles of the same size (indirect impact). Particle contact is modeled with and without friction. The spatial and temporal average stresses and strains at the particle-coupon interface are compared with the in-situ shock response of the particle. The results obtained to date indicate that in spite of the wave reflections and reverberations within the coupon, the particle-coupon interface response can be statistically correlated to the in-situ shock response.

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