MESOSCALE COMPUTATIONAL INVESTIGATION OF SHOCKED HETEROGENEOUS MATERIALS: STRENGTH OF ROCKS UNDER IMPACT LOADING. D. A. Crawford[1] and O. S. Barnouin-Jha[2], [1]Sandia National Laboratories, Albuquerque, New Mexico, USA (dacrawf@sandia.gov), [2]The Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, USA.

Introduction: The propagation of shock waves through target materials is strongly influenced by the presence of small-scale structure, fractures, physical and chemical heterogeneities. Reverberations behind the shock from the presence of physical heterogeneity have been proposed as a mechanism for transient weakening of target materials [1] as are localized shock effects seen in some meteorites [2]. Pre-existing fractures can also affect melt generation [3].

Approach: In this study, we are attempting to bridge the gap in numerical modeling between the micro-scale and the continuum, the so-called meso-scale. To accomplish this, we are developing a methodology to be used in the shock physics hydrocode (CTH) [4] using Monte-Carlo-type methods to investigate the shock properties of heterogeneous materials. By comparing the results of numerical experiments at the micro-scale with experimental results [5] and by using statistical techniques to evaluate the performance of simple constitutive models, we hope to construct more complex constitutive models that mimic the *effects* of micro-scale heterogeneity at the continuum level without incurring high computational cost.

Discussion: In previous work, we demonstrated our numerical approach using a two dimensional plane-strain computation of a mixture of two fictitious linear shock-particle velocity materials [6]. A random distribution of equal-sized grains of these two materials propagated a shock wave with average linear shock-particle velocity in agreement with the EOS mixture theory of Grady [7]. In the present work, we will apply this methodology to help investigate the role of heterogeneity on the shear and fracture strength of rocks. We hope to use this technique to quantify the degree of weakening due to shock loading of heterogeneous materials and determine if the weakening is transient or permanent, localized or global. The results of the study will be calibrated with experiments [5] and naturally shocked materials [2] and applied to simulations of large crater formation [8].

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