Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Multi-scale modeling of deformation and fracture of ceramic materials under dynamic loading EVGENIYA SKRIPNYAK, VLADIMIR VLADIMIROVICH SKRIPNYAK, VLADIMIR ALBERTOVICH SKRIPNYAK, IRINA VAGANOVA, NATALIYA SKRIPNYAK, National Research Tomsk State University — The multi-scale approach to dynamic analysis of deformation and fracture, taking place in structured condensed matter show a great promise in prediction of the mechanical response for new materials. In present work the results of two-level simulations on deformation and fracture mechanisms for brittle materials subjected to impulse and shock-wave loadings are demonstrated. The dynamic effects occurring in structured representative volumes of the ceramics and the processes relating to damage and fracture of the ceramic materials with porous structures, ceramic composites and nanocomposites were modeled using the SPH methods. The grain, phase and porous structures were simulated in an explicit form. The presence of dispersed inclusions, dislocation substructures, nano - and micro-voids at the lower structural level were taking into account in an implicit form. The two-level model allows taking into account different relaxation and fracturing characteristic times at the different structural levels. This approach suggest to describe the relaxation process at the higher structural level in terms of integrated effect of the lower level processes. It is found that clusters of nano-voids in ceramic materials are the centers of damage nucleation. The presence of the clusters of nano-voids in ceramic materials subjected to dynamic loadings results in decrease of the Hugoniot elastic limit value.

Evgeniya Skripnyak
National Research Tomsk State University

Date submitted: 19 Feb 2013 Electronic form version 1.4