Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Shock-induced Plasticity and Brittle Cracks in Aluminum Nitride PAULO BRANICIO, Universidade Federal de Sao Carlos, RAJIV KALIA, AIICHIRO NAKANO, PRIYA VASHISHTA, University of Southern California — Two hundred and nine million atom molecular-dynamics simulation of hypervelocity projectile impact in aluminum nitride reveals strong interplay between shock-induced structural phase transformation, plastic deformation and brittle cracks. The shock wave splits into an elastic precursor and a wurtzite-to-rocksalt structural transformation wave. When the elastic wave reflected from the boundary of the sample interacts with the transformation wave front, nanocavities are generated along the penetration path of the projectile and dislocations in adjacent regions. The nanocavities coalesce to form mode I brittle cracks while dislocations generate kink bands that give rise to mode II cracks. These simulations provide a microscopic view of defects associated with simultaneous tensile and shear cracking at the structural phase transformation boundary due to shock impact in high-strength ceramics.

Paulo Branicio
Universidade Federal de Sao Carlos

Date submitted: 01 Dec 2004

Electronic form version 1.4