Abstract Submitted
for the SHOCK11 Meeting of
The American Physical Society

Penetration scaling in atomistic simulations of hypervelocity impact[1] C.J. RUESTES, E.M. BRINGA, F. FIORETTI, ICB, UN Cuyo, Argentina, A. HIGGINBOTHAM, University of Oxford, UK, E.A. TAYLOR, Open University, UK, G. GRAHAM, The Natural History Museum, UK — We present atomistic molecular dynamics simulations of the impact of copper nano particles at 5 km/s on copper films ranging in thickness from 0.5 to 4 times the projectile diameter. We access both penetration and cratering regimes with final cratering morphologies showing considerable similarity to experimental impacts on both micron and millimeter scales. Both craters and holes are formed from a molten region, with relatively low defect densities remaining after cooling and recrystallisation. Crater diameter and penetration limits are compared to analytical scaling models: in agreement with some models we find the onset of penetration occurs for $1.0 < f/d < 1.5$, where f is the film thickness and d is the projectile diameter. However, our results for the hole size agree well with scaling laws based on macroscopic experiments providing enhanced strength of a nano-film that melts completely at the impact region is taken into account. Penetration in films with pre-existing nanocracks is qualitatively similar to penetration in perfect films, including the lack of back-spall. Simulations using "peridynamics" are also described and compared to the atomistic simulations.

[1]Work supported by PICT2007-PRH, PICT-2008 1325, and SeCTyP.

Eduardo Bringa
CONICET & ICB, UN Cuyo, Mendoza, Argentina

Date submitted: 23 Feb 2011 Electronic form version 1.4