Abstract Submitted
for the SHOCK17 Meeting of
The American Physical Society

Investigation of the static and dynamic fragmentation of metallic liquid sheets induced by random surface fluctuations OLIVIER DURAND, LAURENT SOULARD, EMERIC BOURASSEAU, GAELLE FILIPPINI, CEA, DAM, DIF — When a metal with a roughened free surface is shock-loaded above its fusion point, it can eject liquid sheets which will break up. We investigate the role of random surface fluctuations when the fragmentation of such sheets is simulated using molecular dynamics (MD). Static and dynamic regimes of fragmentation are considered. The static fragmentation is analyzed by simulating sheets of various thicknesses, and the dynamic fragmentation is ensured by applying along the longitudinal direction of a sheet an instantaneous expansion rate. The simulations show that the static/dynamic fragmentation becomes possible when the fluctuations of the upper and lower surfaces of the sheets can either overlap or make the local volume density of the system go down below a critical value. These two mechanisms cause locally in the sheet the random nucleation of pores of void which develop afterwards following distinct stages of growth, coalescence, and percolation. A model derived from the simulations suggests that both dynamic and static regimes of fragmentation are similar for expansion rates below typically 1×10^7 s^{-1}. This study could provide a help in the investigation of the fragmentation of dynamic sheets at higher scales than those of MD.

Olivier Durand
CEA, DAM, DIF

Date submitted: 02 Mar 2017 Electronic form version 1.4