Abstract Submitted
for the SHOCK09 Meeting of
The American Physical Society

Microscopic theory and kinetic model of fracture of liquids VASILIY PISAREV, ALEXEY KUKSIN, GENRI NORMAN, VLADIMIR STEGAILOV, ALEXEY YANILKIN, Joint Institute for High Temperatures of RAS, Moscow, Russia — Fracture kinetic model of liquids based on molecular dynamics simulations is presented. Stretched liquid appears as a result of large energy deposition to condensed matter, for example, under laser processing or shock-wave loading of materials. The kinetic model of fracture includes two processes: nucleation and growth of voids (NAG approach). The rates of nucleation and growth of voids are evaluated separately from molecular dynamics simulations on the example of Lennard-Jones liquid. Pressure and temperature dependences of nucleation rate can be approximated in the form of classical nucleation theory. The kinetics of void growth is shown to satisfy the hydrodynamic Rayleigh-Plesset equation. The fracture kinetics and spall strength are determined by means of the proposed model. The results of calculations show good agreement with the experimental data. This work was supported by the RAS programs # 11, 12, and SNL under the US DOE/NNSA ASC program.

Alexey Yanilkin
Joint Institute for High Temperatures of RAS, Moscow, Russia

Date submitted: 17 Feb 2009 Electronic form version 1.4