Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

The Spall Strength and Hugoniot Elastic Limit of Monocrystalline and Polycrystalline Copper near Melting Temperature SERGEY RAZORENOV, Institute of Problems of Chemical Physics RAS, Russia, EUGENY ZARETSKY, Ben Gurion University of the Negev, Israel, ANDREY SAVINYKH, Institute of Problems of Chemical Physics RAS, Russia — In the present work the Hugoniot elastic limit (HEL) and the spall strength of the polycrystalline commercial grade copper and of the copper single crystal of [100] and [111] orientations were determined for the sample temperatures varying from 293 to 1353K, what is some 3K below the copper melting point Tm. The preheated samples in thickness between 0.5 and 2 mm were shock-loaded by the copper plates of 1-mm thickness accelerated up to 300-400-m/s velocity in the 58-mm smooth bore gas gun, or by the aluminum plates of 0.4 mm in thickness accelerated up to ∼660 m/s with explosive facilities. The velocity histories of the free rear surface of the loaded samples were recorded with VISAR laser velocimeter. The velocity histories of the samples of polycrystalline copper demonstrate 9-fold growth of the stress at HEL between room and melting temperatures. Unlike the other metals, commercial grade copper maintains a very high spall strength near melting point; it is only twice as low as that of the copper at 0.85 Tm. The copper single crystals of the both orientations also demonstrate substantial spall strength at 0.94 Tm (1273K). But the increase of the stress at HEL with temperature in these samples is much weaker than that found for polycrystalline samples of copper.

Sergey Razorenov
Institute of Problems of Chemical Physics RAS

Date submitted: 06 Feb 2013 Electronic form version 1.4