Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Shock waves in polycrystalline iron: plasticity and phase transitions[1] EDUARDO BRINGA, CONICET and Instituto de Ciencias Basicas, Universidad Nacional de Cuyo, Mendoza, Argentina, NINA GUNKELMANN, Physics Department and Research Center OPTIMAS, University Kaiserslautern, Kaiserslautern, Germany, CARLOS RUESTES, Instituto de Ciencias Basicas, Universidad Nacional de Cuyo, Mendoza, Argentina, HERBERT URBASSEK, Physics Department and Research Center OPTIMAS, University Kaiserslautern, Kaiserslautern, Germany — Iron undergoes a bcc to close-packed structural phase transition under pressure, at around 13 GPa. Atomistic simulations have been able to provide insights into the transition, but without dislocation plasticity occurring before the phase change, while experiments in polycrystals do show clear evidence for dislocation plasticity. Here we study shock waves in polycrystalline Fe using two different interatomic potentials, below and above the phase transition pressure. We show that it is essential to employ a finite ramp time of the shock wave in the crystal in order to give dislocations sufficient time for nucleation. For grain sizes below 10 nm, where a significant fraction of the plastic activity can occur by grain boundary sliding, dislocation nucleation still is a relatively small contribution to shear stress relaxation.

[1]NG and HMU thanks support from the Deutsche Forschungsgemeinschaft via the Sonderforschungsbereich 926. CJR and EMB thank support from SeCTyP U. N. Cuyo and PICT2008-1325.

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Date submitted: 22 Feb 2013 Electronic form version 1.4