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Kinetic Approach for Shock Compressed Heterogeneous Medium
YURI MESCHERYAKOV, IPME RAS, V.O. Bol'shoi 61, 199178, Saint-Petersburg, Russia — On the basis of experiments on shock loading of wide spectrum of materials, a criterion for changing the energy exchange regime between mesoscale and maroscale from evolutional to catastrophical is obtained. Intermediate regime of energy exchange is shown to be oscillating one. Two-level theoretical approach to uniaxial strain of heterogeneous medium is based on locking the momentum and mass balance equations (macroscopic scale level) with the kinetic equation for mesoparticle velocity distribution function (mesoscale). Constitutive equation $P = \rho D^2$ links the spherical component of pressure and particle velocity dispersion which plays a role "granular temperature" at the mesoscale. A coupling between mesoscale and macroscale levels results from current energy exchange by using the relationship between particle velocity dispersion and mean velocity loss $\Delta u = \frac{1}{2}\frac{\partial D^2}{\partial u}$. It characterizes the losses of momentum at the macroscalel at the expense of outflow of the energy to mesoscale whereas dispersion D^2characterizes the reversible energy of fluctuations at the mesoscale. The criterion for transition from homogeneous to heterogeneous straining is shown to be the ratio of rate of change of velocity dispersion and rate of change of mean particle velocity at the shock front of compressive pulse.

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