Abstract Submitted
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Numerical simulation of multiscale damage-failure transition and shock wave propagation in metals and ceramics[1] YURIY BAYANDIN, NATALIA SAVELIEVA, Institute of continuous media mechanics of Ural branch of RAS, Russia, Perm, ANDREY SAVINYKH, Institute of problems of chemical physics of RAS, Russia, Chernogolovka, OLEG NAIMARK, Institute of continuous media mechanics of Ural branch of RAS, Russia, Perm — Statistical theory of evolution of typical mesoscopic defects revealed specific type of criticality–structural-scaling transitions and allowed the development of phenomenology of damage and plastic flow in materials under intensive loading, which established characteristic multiscale collective modes of defects responsible for formation of plastic waves and damage-failure transition. Original approach based on wide range constitutive equations was developed for simulation of multiscale damage-failure transition mechanisms and shock wave propagation in metals and ceramics in range of strain rate $10^3 - 10^8 s^{-1}$. It was shown that mechanisms of a plastic relaxation and damage-failure transitions are linked to multiscale kinetics of mesodefects collective modes with the nature of solitary waves and blow-up dissipative structures consequently. Numerical simulation of original plate impact tests showed that the model describes shock wave loading for metals and ceramics, and allowed us to explain the effect of power law phenomena of plastic wave fronts formation, its self-similar features under reloading and unloading. Analysis of shock wave profiles in ceramics for different thicknesses of specimens in terms of self-similar variables supports the universality of shock wave fronts.

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