

**Theory and atomistic modeling and simulation of relaxation processes
in condensed matter**

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In this report I will consider the relaxation processes at extreme states that accompany the material response on high rate energy deposition: plastic deformation and fracture of solids and rupture of liquids under high strain rates during shock-wave loading, bulk and surface melting at high pressures and temperatures, effects of ultrafast energy deposition into the electron subsystem on stability of crystals. The level of computational complexity of classical and quantum atomistic models under consideration requires the deployment of the modern supercomputer of the teraflops power. The multiscale approaches are developed for the application of the results on the time and length scales beyond the current direct accessibility of the atomistic methods.