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Interaction of Short Pulse Laser Irradiation with Metal Targets under Condition of Spatial Confinement[1] MAXIM SHUGAEV, EAMAN KARIM, CHENG-YU SHIH, CHENGPING WU, LEONID ZHIGILEI, Univ of Virginia — While the general mechanisms of laser interactions with metals in vacuum have been broadly investigated experimentally, theoretically and computationally, the effect of strong spatial confinement by solid or liquid overlayers on the laser induced processes remains largely unexplored. In this work, the results of large-scale atomistic simulations of short pulse laser irradiation of metal targets in liquid environment and in the presence of a transparent silica glass overlayer are used to reveal the effect of the spatial confinement on the material response to the fast laser energy deposition. The ability of the overlayer to suppress generation of unloading tensile wave, prevent photomechanical spallation and explosive decomposition of the surface region of the target, and facilitate the formation of a high pressure and temperature supercritical state near the interface is revealed in the simulations. The results of the simulations clarify the mechanisms responsible for structural and morphological changes in the interfacial region, formation of voids and crystal defects, and generation of nanoparticles.

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