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Cooling rates and mechanisms of resolidification in short pulse laser processing of metal targets[1] LEONID ZHIGILEI, ZHIBIN LIN, WILLIAM DUFF, University of Virginia, DMITRIY IVANOV, Technical University of Kaiserslautern — Short-pulse laser irradiation of a metal target can create conditions for generation of non-equilibrium phases and unusual microstructure in the surface region of the irradiated target. The shallow melt depths produced by the short pulse laser irradiation and the high thermal conductivity of metals can result in very high cooling rates, strong undercooling and rapid resolidification. In this work, the melting and resolidification processes occurring under conditions of extreme heating and cooling rates are investigated in large-scale molecular dynamics simulations. The kinetics of the resolidification process and the microstructure of the surface region are found to be defined by a competition between the epitaxial regrowth of the substrate and nucleation of crystallites within the undercooled melted region. The dependence of the final microstructure of the surface region on the irradiation conditions is discussed.

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