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Atomistic Investigation of the Effect of Crystallographic Orientation on Laser-Induced Generation of Crystal Defects in Metals MAXIM SHUGAEV, CHENGPING WU, LEONID ZHIGILEI, University of Virginia — The results of the recent electron backscatter diffraction measurements [Sedao *et al.*, Appl. Phys. Lett. 104, 171605, 2014] are suggesting a strong effect of the crystallographic orientation of grains in polycrystalline metal targets on the generation and accumulation of crystal defects in the surface region of the irradiated targets. In order to explain the experimental observations and to reveal the physical origin of the sensitivity of the laser-induced surface modification to the crystallographic orientation of irradiated surface, a series of large-scale atomistic simulations of femtosecond laser irradiation of Ni targets with (001), (011), and (111) surface orientations is performed. The results of the simulations do confirm the significant influence of the crystal orientation on the formation of sub-surface defects and provide detailed information on the defect configurations generated in each target. Overall, the results of this investigation clarify the mechanisms responsible for the laser-induced generation of crystal defects, including generation of growth twins and dislocation during rapid resolidification, and explain the sensitivity of the structural modification of metal surfaces to the crystallographic orientation of irradiated targets.

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