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Molecular dynamics simulations of shock wave propagation in single crystal copper ROMAIN PERRIOT, VASILY ZHAKHOVSKY, IVAN OLEYNIK, University of South Florida — Various regimes of shock wave propagation, including both elastic-plastic split-shock waves and single two-zone elastic-plastic shock waves, were studied by molecular dynamics (MD) simulations in single crystal copper oriented along the <100>, <110>, and <111> directions using both traditional piston-driven and the newly developed moving window MD techniques. The single two-zone elastic-plastic shock wave consists of the elastic zone followed by a plastic zone, where both elastic and plastic fronts move with the same speed, thus maintaining on average a constant separation. Although the properties of the leading elastic zone in both split-shock wave and single two-zone regimes are orientation-dependent, the thermodynamic properties of the plastic state are not once the steady-state regime is achieved in micrometer-thick films. The orientation-independent plastic Hugoniot obtained in our MD simulations agree with experimental observations of orientation-independent shock-wave propagation in single crystal copper [1].

[1] R. Chau, J. Stölken, P. Asoka-Kumar, M. Kumar, and N. C. Holmes, J. Appl. Phys. 107, 023506 (2010).

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