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Orientation-dependent structure of elastic and plastic shock waves in Nickel single crystals BRIAN DEMASKE, VASILY ZHAKHOVSKY, University of South Florida, NAIL INOGAMOV, Landau Institute for Theoretical Physics, IVAN OLEYNIK, University of South Florida — The response of Ni single crystals to shock loading has been investigated using molecular dynamics (MD) simulations. It was found that within the elastic-plastic split-shock-wave regime, the amplitude of the elastic precursor in the [111] direction depends strongly on the pressure of the plastic wave; whereas in the [110] direction the pressure of the elastic precursor is pinned. Coupling of the elastic and plastic waves in the [111] direction and lack thereof in the [110] direction is attributed to different activation mechanisms for homogeneous dislocation nucleation (HDN), the major relaxation process observed in our MD simulations. In the [111] direction, thermodynamic fluctuations activate HDN randomly within a metastable elastic zone separating the elastic and plastic fronts, while in the [110] direction HDN is induced by the high levels of shear stresses produced at the plastic front. We will discuss how thermally-activated HDN gives rise to a new pulsating regime of single two-zone elastic-plastic shock waves, where the elastic zone width undergoes significant oscillations in time.

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