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Rarefaction shock waves in shock-compressed diamond <110> crystal ROMAIN PERRIOT, YOU LIN, VASILY ZHAKHOVSKY, University of South Florida, CARTER WHITE, Naval Research Laboratory, IVAN OLEYNIK, University of South Florida — Piston-driven shock compression of diamond <110> crystal was simulated by molecular dynamics using the REBO potential. At piston velocities between 2 and 5 km/s and corresponding pressures 117 GPA $<$ P $<$ 278 GPa, diamond sample undergoes a polymorphic phase transition, characterized by the coexistence of two elastically compressed phases, low-pressure phase A and high-pressure phase B. This phase transition results in the splitting of the shock wave into two elastic shock waves, composed of pure phase A and a mixture of phases A and B. Upon removal of the piston, a release wave is observed at the rear of the sample, turning into a rarefaction shock wave where the material undergoes the reverse phase transition from coexisting phases to the original low-pressure phase. For strong plastic waves induced by larger piston velocities the release wave propagates as a rarefaction wave without any phase transition corresponding to the adiabatic expansion along the plastic branch of the Hugoniot.

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