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Numerical modeling of solid-cluster evolution applied to the nanosecond solidification of water through ramp and shock-wave compression[1] DANE STERBENTZ, University of California, Davis, PHILIP MYINT, Lawrence Livermore National Laboratory, JEAN-PIERRE DELPLANQUE, University of California, Davis, JONATHAN BELOF, Lawrence Livermore National Laboratory — Classical nucleation theory (CNT) is a promising way to predictively model the sub-microsecond kinetics of rapid phase transitions that occur under ramp or shock compression, such as the suite of experiments performed over the past two decades on the solidification of liquid water to the high-pressure ice VII phase. We model the liquid water–ice VII phase transformation in these hydrodynamic-loading experiments using a numerical discretization scheme to solve the Zel'dovich–Frenkel partial differential equation (a fundamental CNT-based kinetic equation that describes the statistical time-dependent behavior of solid cluster formation and accounts for transience in the nucleation kinetics) as well as through hydrodynamics simulations. We have also developed a new dimensionless parameter that may be applied *a priori* to predict whether or not transient nucleation will be important in a given ramp- or shock-compression experiment.

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