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Study of shock growth of ice VI single crystal near equilibrium melting pressure with dynamic diamond anvil cell YONG-JAE KIM, Lawrence Livermore Natl Lab, Korea Research Institute of Standards and Science, YUN-HEE LEE, SOOHEYONG LEE, Korea Research Institute of Standards and Science, HIROKI NADA, National Institute of Advanced Industrial Science and Technology, GEUN WOO LEE, Korea Research Institute of Standards and Science
— Crystal growth under local non-equilibrium condition shows diverse growth morphologies and mechanisms. To reveal the origin of the diverse growth behavior, we systematically control the growth condition from local equilibrium to local non-equilibrium by increasing compression rate from ˜10^{-3} /s to ˜1 /s with an advanced dynamic diamond anvil cell (dDAC). We find anomalously fast growth, or shock crystal growth, of ice VI single crystal with a morphological transition from three- to two-dimension (3-d to 2-d) under rapid compression of >˜0.1 /s. Unlike expectation, the shock growth occurs from the edges of three-dimensional seed crystal rather than its corners. Despite of small average supercompression of <˜0.06 GPa, the fast compression yields effectively large overpressure at the crystal-liquid interface, manifesting the local non-equilibrium condition to initiate shock growth. Molecular dynamics (MD) simulation reproduces the faster growth of the shock growth plane upon applying large overpressure and reveals the similarity of the interface structure between water and the shock growth crystal plane. *Part of this work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-ABS-768460.

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