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Hydrocode and Molecular Dynamics modelling of uniaxial shock wave experiments on Silicon PAUL STUBLEY, DAVID MCGONEGLE, SHAMIM PATEL, MATTHEW SUGGIT, JUSTIN WARK, University of Oxford, ANDREW HIGGINBOTHAM, University of York, ANDREW COMLEY, JOHN FOSTER, STEVE ROTHMAN, AWE, UK, JON EGGERT, DAN KALANTAR, RAY SMITH, LLNL, CA — Recent experiments have provided further evidence that the response of silicon to shock compression has anomalous properties, not described by the usual two-wave elastic-plastic response. A recent experimental campaign on the Orion laser in particular has indicated a complex multi-wave response. While Molecular Dynamics (MD) simulations can offer a detailed insight into the response of crystals to uniaxial compression, they are extremely computationally expensive. For this reason, we are adapting a simple quasi-2D hydrodynamics code to capture phase change under uniaxial compression, and the intervening mixed phase region, keeping track of the stresses and strains in each of the phases. This strain information is of such importance because a large number of shock experiments use diffraction as a key diagnostic, and these diffraction patterns depend solely on the elastic strains in the sample. We present here a comparison of the new hydrodynamics code with MD simulations, and show that the simulated diffraction taken from the code agrees qualitatively with measured diffraction from our recent Orion campaign.

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