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Effect of Dynamic Loading Rate on the Uniaxial Dynamic Tensile Response in Commercially Pure 1050 Aluminum NATHANIEL SANCHEZ, DARCIE DENNIS-KOLLER, Los Alamos National Laboratory, DAVID FIELD, Washington State University — A series of plate impact experiments were conducted to investigate the effect of dynamic loading rate on the uniaxial dynamic tensile response of commercially pure 1050 aluminum. The loading rate (kinetic effect) was varied by altering the shock-wave shape, while the total defect density loaded in dynamic tension was held constant (spatial effect). The maximum tensile stress magnitude was held constant for all experiments in order to solely examine the effects of dynamic loading rate. Samples were soft recovered and analyzed via Electron Backscatter Diffraction (EBSD) to correlate damage to microstructural features. An optical velocimetry (VISAR) trace from the free surface was utilized to correlate the effects of damage growth rate observed through EBSD to changes in free surface velocity pull back rate. Results indicate as the dynamic tensile evolution rate was increased, a transition occurs from slow damage mechanisms of individual void nucleation and growth, to a fast mechanism of lattice curvature resulting in no observable macroscopic damage. These results suggest damage models must account for wave evolution in order to provide a robust predictive capability.

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