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Elastic precursor wave decay in shock-compressed aluminum over a wide range of temperature[1] RYAN AUSTIN, Lawrence Livermore Natl Lab — As a part of broader efforts to understand the dynamic strength of metals, precursor wave decay measurements are well-situated to probe time-dependent flow behavior at relatively high strain rates and low strain levels. Such measurements provide crucial data to help constrain models of underlying deformation mechanisms and microstructure evolution under shock wave loading. In previous work, wave structures were measured in aluminum plate impact experiments performed at temperatures ranging from 300 K to just below the ambient melting point (933 K). These measurements serve as a basis for evaluating and refining a dislocation-based model of high-rate metal plasticity. In the experiments, the precursor wave amplitudes were observed to increase with temperature. This effect is usually explained in terms of the temperature dependence of dislocation phonon scattering (i.e., the linear regime of damped dislocation mobility). However, the model predicts that phonon radiation provides a somewhat stronger damping effect at all temperatures, given the high speeds attained by the dislocations. The combined effects of phonon scattering and radiation then seem to be responsible for the measured precursor amplifications.

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