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Interaction of Material Strength With Ramp and Shock Wave Loading¹ JOW-LIAN DING, Washington State University, JAMES ASAY, Sandia National Laboratories — The objective of the current study is to gain a detailed understanding of the interaction of the material strength with the ramp and shock wave loadings. The ultimate goal is to use the foundation established in this study to develop a practical methodology to extract strength information from ramp and shock wave experiments. A forward, numerical-simulation-based cause and effect analysis is used to address this objective. The apparent strength associated with shock and ramp wave loadings with different risetimes and shapes is investigated. It is shown that intrinsic material strength can vary with pressure, temperature, and deformation history, but the apparent strength, which is larger than the intrinsic strength, is a result of the interaction between the rate sensitivity of the strength and the strain rate history imposed by the external loading. The degree of interaction leads to different levels of mechanical and thermal dissipations and their partition, which are manifested by different temperature, stress, and deformation histories. By varying the risetimes and/or shapes of ramp wave, different strain rate histories can be produced. Thus ramp wave experiment is potentially a very effective tool to probe the rate sensitivity of material strength.

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