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Investigation of Mixing Law Efficacy for Hydrodynamic Simulations and Associated Compressibility Implications CALEB WHITE, HUMBERTO SILVA III, Sandia National Laboratories, PETER VOROBIEFF, Department of Mechanical Engineering, University of New Mexico — A computational simulation of various mixing laws for gaseous equations of state (EOS) using planar traveling shocks for multiple mixtures in three dimensions (3D) is analyzed against nominal experimental data. Numerical simulations utilize the Sandia National Laboratories (SNL) shock hydrodynamic code CTH and other codes including the SNL thermochemical equilibrium code TIGER and the uncertainty qualification (UQ) and sensitivity analysis code DAKOTA. The mixtures are: a 1:1 and a 1:4 molar mixture of helium (He) and sulfur hexafluoride (SF_6). The mixing laws to be analyzed are the ideal gas law, Amagat's Law, and Dalton's Law. Examination of the experimental data with TIGER revealed that the shock strength should not be strong enough to turn the mixture non-ideal as the compressibility factor, z, was essentially unity ($z \approx 1.02$). Strikingly however, experimental results show that neither Dalton's nor Amagat's Law are able to accurately predict the properties of the shocked mixture. A methodology is being developed to possibly optimize the various mixing laws with computational results for the data set investigated. Lastly, a framework for future sensitivity and uncertainty quantification analysis will be established.

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