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A Multiphase Approach for Modeling the Shock Response of Unidirectional Composite Materials SHANE SCHUMACHER, Sandia National Laboratories, CHRIS KEY, HI Test Laboratories, KEVIN RUGGIRELLO, SCOTT ALEXANDER, Sandia National Laboratories — The shock response of unidirectional fiber reinforced composite materials is inherently anisotropic due to their microstructural geometric configuration. Unlike typical elastic-plastic materials, composite materials form the observed two-wave structure under longitudinal shocks due to a precursor wave travelling through the fibers ahead of a bulk wave in the resin constituent. The nature of this response presents a problem in traditional hydrocode frameworks where each cell or material point tracks only a single velocity field. This paper outlines an adaptation of the Baer and Nunziato multi-phase model in CTH where a mixture rule is used to determine the velocity field of each constituent (fiber and matrix) of the composite material. The model modifies the momentum exchange term to represent the frictional drag forces between the fiber and matrix constituents, while assuming no mass or energy exchange. The momentum drag model is dependent not only upon the pressure difference between the constituents but also the directional dependence of the shock response. Finally, the model is implemented and compared to experimental data.

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