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Shock compression response of Ti+B reactive powder mixtures[1]
MANNY GONZALES, ASHOK GURUMURTHY, GREGORY KENNEDY, ARUN GOKHALE, NARESH THADHANI, Georgia Institute of Technology — The shock compression response of Ti+2B (1:2 Ti:B stoichiometric ratio) reactive powder mixtures at $\sim$ 50% theoretical material density (TMD) is investigated for shock pressures up to 5 GPa to investigate the possible shock-induced chemical reactivity of this highly exothermic mixture. The shock adiabat is produced from instrumented parallel-plate gas-gun impact experiments on encapsulated powders using poly-vinylidene fluoride (PVDF) stress gauges to measure the input and propagated stress and wave speed in the powder. The shock compression regime is probed from crush-up to full density and onward to assess the potential onset of a shock-induced chemical reaction event in the powder mixture. A series of two-dimensional continuum meso-scale simulations on real and simulated microstructures are performed to predict the shock compression response and identify the meso-scale mechanics that is essential for the so-called "ballotechnic" reaction. These meso-scale mechanics are investigated through stereological evolution metrics that track particle interface evolution and their respective field variables. The suitability of the synthetic microstructural representations is evaluated by comparing the experimental and predicted pressure traces.

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