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Advanced Plasticity Models Applied to Recent Shock Data on Beryllium MICHAEL PRIME, CHRIS ADAMS, SHUH-RONG CHEN, Los Alamos National Laboratory — Recent plate impact experiments with pressures from 2 to 20 GPa have been performed on vacuum hot-pressed S-200F Beryllium. This hexagonal close-packed (HCP) metal shows significant plasticity effects. To examine the validity of advanced plasticity models in the shock regime, the plate impact experiments were modeled using a Lagrangian hydrocode. Two constitutive strength (plasticity) models, the Preston-Tonks-Wallace (PTW) and Mechanical Threshold Stress (MTS) models, were calibrated using the same extensive set of quasi-static and Hopkinson bar data taken at temperatures from 77K to 873K and strain rates from 0.001/sec to 4300/sec. In spite of being calibrated on the same data, the two models give noticeably different results when comparing with the experimentally measured wave profiles. Neither model is unequivocally superior, with each matching some aspects of the data better. The reasons for the differences are explored and discussed. Differences between the two models are particularly evident during reverse loading upon shock release, which is also examined. The performance of simpler plasticity models than PTW or MTS in simulating the impact tests is also presented for reference.

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