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Constitutive modelling of phase transition in iron under sweeping detonation wave loading A.D. RESNYANSKY, WCSD, Defence Science and Technology Group, PO Box 1500, Edinburgh SA 5111, G.T. GRAY III, L.M. HULL, B.J. WARTHEN, Los Alamos National Laboratory, Los Alamos, NM 87545, USA —
The well-known alpha-epsilon phase transition in iron has a very accurately determined phase transition pressure value of 13 GPa from numerous plane impact tests. However, a more recent experimental study, using a sample loaded by a sweeping detonation wave, has measured a decreased transition value to that observed in the plane tests. The present analysis is developed in order to study if martensitic character of the phase transition is a possible mechanism of the transition in the sliding wave loading conditions. A two-phase model is employed that is complemented with the phase-transition kinetic taking into account the shear stress factor. A set of constitutive equations describing the rate sensitive strength response and the phase transition kinetic complements the conservation laws of the model. The model implemented in CTH is used for simulation of the experiments. Results of modelling of a sliding wave loading experiment demonstrate that the observed phase transition occurring at a reduced transition pressure can be described with the martensitic mechanism.

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