Insights: Publications

Plasticity-Damage Modeling of Strain Rate and Temperature Dependence of Aluminum Alloy 7075-T651

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This is the first study to correlate the observed damage evolution of ambient (298 K) and elevated (480 K) temperatures of quasi-static and dynamically-loaded wrought aluminum alloy 7075 (AA7075) to capture the strain rate and temperature influence on flow behavior with one set of material constants. In this research, an internal state variable (ISV) framework implementing a physically-based plasticity and damage constitutive model was used to capture the strain rate and temperature dependence of the wrought Al-Zn-Mg-Cu aluminum alloy. The model includes microstructural content processing history and is consistent with continuum level kinematics, kinetics, and thermodynamics. The ISV model captures deformations due to kinematic and isotropic stress-state dependent hardening and damage from the microscale that arise from microstructural features and defects in the wrought aluminum alloy. In addition, the ISV damage theory is based on void nucleation, void growth, and void coalescence. This research provides a foundation for capturing the structure-property relations from the microscale to the structural scale. Finite element methods coupled with internal state variables used to model the plasticity and damage state at the structural scale for high fidelity dynamic loading scenarios, such as blast and impact loading conditions.

Related People



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