

Finite Element Modeling and Simulation of Bulk Metallic Glasses

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Abstract – We present a finite-deformation continuum model for the constitutive behavior of bulk metallic glass (BMG). A stored plastic work function with dependency on the volumetric plastic strain is proposed to model the pressure sensitivity of BMG, and a non-Newtonian viscosity model is used to simulate strain-rate and temperature effects. Surface-like shear band elements govern the initiation and formation of shear bands, allowing the model to resolve small-scale strain localizations by a standard finite element discretization, which is also compatible with the bulk material. The BMG model is validated by comparing the results of numerical simulations of Vitreloy 1 BMG at various strain rates and temperatures with available experimental data.

Key Words: bulk metallic glass, finite deformation plasticity, pressure sensitivity