Interplay of martensitic phase transformation and plasticity in shape memory polycrystalline alloys: energetic considerations-based constitutive modeling

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Abstract

Due to the possible concurrent activation of multiple inelastic deformation mechanisms, shape memory alloys exhibit a strongly nonlinear mechanical response. Recent experimental and theoretical findings shed new light on the plastic processes running in NiTi alloys and their interplay with martensitic phase transformation. Based on this we have formulated a novel constitutive model that carefully addresses such phenomena via a thermodynamically consistent variational formulation. Its core consists of conventional stored energy and a tailored dissipation function/potential. The model has been validated on a comprehensive set of experimental data and has been implemented in a finite element code to enable simulations of engineering structures.

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