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A thermodynamically consistent distortional hardening model for AZ31 with experimental validation

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ABSTRACT

Magnesium alloy is a lightweight structural metal; however, it exhibits strong anisotropy due to texture, which restricts its use in energy-saving lightweight structures. This pronounced anisotropy cannot be characterized by only classical isotropic or kinematic hardening due to the constant shape of yield surface during plastic deformation. Hence, the shape evolution of yield surface, known as distortional hardening, is the main approach to capture the anisotropic behavior of Mg alloy during forming process. Based on elasto-plasticity theory at finite strain, constitutive model with distortional hardening for AZ31 is proposed. Thermodynamical consistency is proved. The anisotropic mechanical behavior of AZ31 sheet is demonstrated after model parameters calibration with experiments.

KEYWORDS: distortional hardening, thermodynamically consistent, finite strain, AZ31, forming process