Strain-dependent constitutive analysis of extruded AZ61 Mg alloy under hot compression

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Abstract

The hot deformation characteristics and constitutive analysis of extruded AZ61 Mg alloy were investigated by hot compression tests conducted in the temperature range of 250 to 450 ˚C and strain rate range of 1×103 to 1 s1. The effect of strain on the constitutive parameters was taken into account in the constitutive analysis. Constitutive equations as a function of strain were established through a simple extension of the hyperbolic sine constitutive relation. The constitutive parameters, stress exponent n, activation energy Q, and ln A in the constitutive equations were calculated as a function of strain. Correlation between the strain-dependent constitutive parameters and flow behavior was analyzed. The constant stress multiplier (α) analysis result indicated that the calculated flow stresses were in good agreement with experimental ones, except at low strains at the deformation conditions with high strain hardening. On the other hand, the constitutive analysis with strain-dependent α value had better estimations between the calculated and experimental flow stresses throughout the entire temperature and strain rate ranges performed in this work.

Keyword：AZ61 Mg alloy; constitutive analysis; dynamic recrystallization; flow stress modeling; stress multiplier