

Hot deformation characteristics and strain-dependent constitutive analysis
of Inconel 600 superalloy

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Abstract

The hot deformation characteristics and constitutive analysis of Inconel (IN) 600 superalloy were investigated at elevated temperatures. Hot compressive tests were carried out in the temperature and strain rate ranging from 900 - 1150 °C and $1 \times 10^3 - 10 \text{ s}^{-1}$, respectively. The flow behavior analyses and microstructural observations indicate that the softening mechanisms were related to dynamic recrystallization (DRX) and grain growth. DRX played a dominant role in the microstructural evolution at low temperatures (or high strain rates). DRX was the dominant softening effect at low strains on testing at high temperatures with low strain rates, whereas growth of the dynamically recrystallized grains was responsible for softening at high strains. The flow stress of IN 600 was fitted well by the constitutive equation of the hyperbolic sine function under the deformation conditions performed in the current work. A constitutive equation as a function of strain was established through a simple extension of the hyperbolic sine constitutive relation.

Keyword : Constitutive analysis; Dynamic recrystallization; Flow behavior; Inconel 600 superalloy; Twinning