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Constitutive behavior and processing maps of low expansion GH909 superalloy

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ABSTRACT

The hot deformation behavior of GH909 superalloy has been studied systematically using isothermal hot compression tests in temperature range of 960–1040°C at strain rates of 0.02–10 s^{-1} with height reduction up to 70%. The relations considering flow stress, temperature, and strain rate have been evaluated *via* power-law, hyperbolic sine, and exponential constitutive equations in different strains conditions, and exponential equation is first found more appropriate for process modeling. The processing maps for the alloy were constructed at the strains of 0.2, 0.4, 0.6, and 0.8 based on the dynamic material model, and a total processing map considering all the investigated strains was proposed. Metallurgical instabilities in the instability domain mainly located at higher strain rates were manifested in the form of adiabatic shear bands and cracking. The stability domain occurred at 960–1040°C and strain rates less than 0.2 s^{-1}, and it is recommended for optimum hot working conditions of GH909 superalloy.