

8th International Conference on Physical and Numerical Simulation of Materials Processing (ICPNS)

14–17 October 2016

Seattle, Washington | Hosted by Purdue University

SESSION 5: IRON AND STEEL, HARBOR HALL

Co-Chairs: Jer-Ren Yang, National Taiwan University; Zhaoxia Qu, Welding and Corrosion Protection Technology Department Research Institute; Josip Brnic, University of Rijeka; Hiromi Miura, Nippon Steel & Sumitomo Metal Corp

SATURDAY, OCTOBER 15, 2016

Constitutive behavior and processing maps of low expansion GH909 superalloy

Zhihao Yao; Shaocong Wu; Jianxin Dong; Maicang Zhang, University of Science and Technology Beijing; Qiuying Yu, Beijing Institute of Aeronautical Materials; Guangwei Han, Central Iron and Steel Research Institute

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.