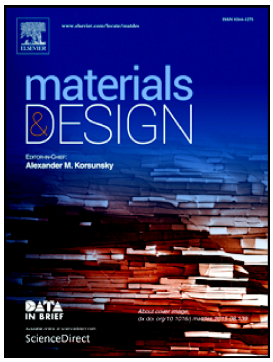

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Hot deformation characteristics and processing map of a phosphorous modified super austenitic stainless steel

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Abstract

Hot deformation behaviour of a phosphorous-modified super austenitic stainless steel was studied in the temperature range of 1173-1423 K and strain rate range of 0.001-10 s^{-1} employing thermomechanical simulator. The apparent activation energy for deformation in the above processing regime was estimated to be 482 $kJmol^{-1}$. The deformation parameters were modeled using Arrhenius equation and Zener–Hollomon parameter (Z). Peak stress, critical stress for dynamic recrystallization, stress at which flow softening is maximum as well as steady state stress was found to exhibit a linear relationship with ln(Z/A). Strains corresponding to these stresses were also found to exhibit the relation $\varepsilon = \mathrm{C}\left(\frac{\mathrm{Z}}{\mathrm{A}}\right)^{\mathrm{p}}$. Processing maps were developed at different plastic strains employing dynamic materials modeling. Microstructures corresponding to the different processing conditions were characterized employing electron back scatter diffraction. Based on the analysis of microstructure and processing map, the optimum processing domain for hot deformation is identified as strain rate range of 0.01-0.1 s^{-1} and temperature range of 1300-1350 K. Although a significant recrystallization was observed following hot deformation in the strain rate ranges of 1-10 s^{-1} and temperature ranges 1373-1423 K, this domain was marked as unstable in the processing map.

Keywords: Super austenitic stainless steel; Hot deformation; Processing map; Microstructure; Dynamic Recrystallization