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ICAM5

Strain hardening behavior analysis of DP 590 steel using dislocation density based Kock-Mecking model

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ABSTRACT

Tensile flow stress and strain hardening behavior has attracted a continued interest in optimizing the process parameters and ensuring safe performance during working conditions. The main aim of the present work is to investigate the strain hardening behavior of DP-590 steel at different temperatures (room temperature to 400^0C) at an interval of 100^0C. Firstly, uniaxial tensile tests have been performed from Room Temperature (RT) to 400^0C at an interval of 100^0C and $0.001s^{-1}$ strain rate. The flow stress behavior of DP-590 steel at different temperature is analyzed. Subsequently, microstructural characteristics of DP-590 steel have been examined using Scanning Electron Microscopy (SEM). Predominantly, ductile type of failure is observed at all the testing conditions. The size of the voids increases with increase in temperature and inclusion pullout was found to be major reason for failure at higher temperature. The strain hardening behavior of DP 590 steel has been investigated using a dislocation density based Kock-Mecking model. The dislocation storage ***(K_1)*** and dislocation annihilation ***(K_2)*** parameters are used to describe the strain hardening behavior. Three stage hardening behavior has been found at different temperatures. Each stage of hardening has been discussed elaborately.

Keywords: DP 590 steel, strain hardening, flow behavior, dislocation density model.