

DETECTION OF DYNAMIC SOFTENING DURING HOT DEFORMATION OF MEDIUM SI-STEELS BY A THERMO- MECHANICAL SIMULATOR

(GLEEBLE 3500)

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ABSTRACT

A Si- steel alloy was processed by melting in a 100-Kg induction melting furnace. The steel was cast as Y-blocks, containing 0.0579% C and 1.66% Si. The Y blocks were forged to 12 mm diameter bars and machined to 10 mm diameter to suite the thermo-mechanical simulator (Gleeble3500) specimens.

The aim of the present work is to detect the dynamic softening phenomena during hot rolling of medium Si-steel by a thermo-mechanical simulator (Gleeble 3500).

Dilatation tests by controlled heating-cooling on steel specimens were carried out. The A_{c1} , T_{nr} , and A_{c3} temperatures were detected. It was found that the measured A_{c1} and A_{c3} temperatures were higher than that calculated using formulas, which are depending on steel chemical composition. Hot rolling schedules ware designed (using Gleeble 3500 instrument) to simulate two passes roughening, followed by three passes finish rolling. 4-rolling schedules were designed using different strain rates (0.01, 0.1, 1.0 and 10.0 s^{-1}), for dynamic softing detection during hot deformation. Dilation detects A_{c1} , A_{c3} and T_{nr} temperatures as 888, 1070 and 953 °C, respectively. A linearly stress – strain relation was noticed at the beginning of each hit, detecting the flow stress (σ_f) for such deformation conditions. σ_f increases from hit to the other, followed by sudden decrease at 950 °C, indicating creation of dynamic recrystallization (DRX). By increasing the strain rate to 10 s^{-1} , a pronounced dynamic recovery (DR ν) followed by DR $_x$ were noticed. The microstructure investigation confirms what have been obtained by simulation.

KEYWORDS: Si- Steel, Hot Rolling Schedules, Thermo- Mechanical Simulation, Critical Temperatures, Amount of Strain, Strain Rate, Flow Stress, Dynamic Recrystallization (DR $_x$)

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