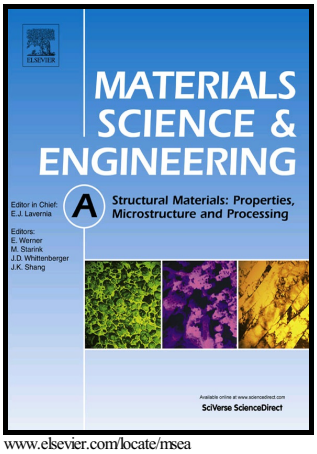
Temperature and Strain rate dependent Deformation Induced Martensitic Transformation and Flow Behavior of Quenching and Partitioning Steels

D.Q Zou, S.H Li, Ji He



www.elsevier.com/locate/msea

PII: S0921-5093(16)31301-6
DOI: http://dx.doi.org/10.1016/j.msea.2016.10.083
Reference: MSA34285

To appear in: *Materials Science & Engineering A*

Received date: 12 July 2016
Revised date: 1 October 2016
Accepted date: 21 October 2016

Cite this article as: D.Q Zou, S.H Li and Ji He, Temperature and Strain rat dependent Deformation Induced Martensitic Transformation and Flow Behavio of Quenching and Partitioning Steels, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2016.10.083

Temperature and Strain rate dependent Deformation Induced Martensitic Transformation and Flow Behavior of Quenching and Partitioning Steels

D.Q Zou[a,b], S.H Li[a,b*], Ji He[a,b]

[a]State Key Laboratory of Mechanical System and Vibration, Shanghai 200240, China

[b]Shanghai Key Laboratory of Digital Manufacture for Thin-walled Structures, Shanghai Jiao Tong University, Shanghai 200240, China

Abstract:

The quenching and partitioning steels have received much attention because of the material's high strength and good ductility, which results from deformation-induced martensitic transformation. To investigate the strain rate and temperature dependence of martensitic transformation and flow behavior, we conducted interrupted uniaxial tension tests and X-ray diffraction. The experiments covered a wide range of strain rate and six ambient temperatures conditions, which are in accordance with conditions encountered in sheet metal forming and car crash process. Based on the martensitic phase transformation behavior and newly proposed heat balance equation, a modified transformation kinetics law was proposed to describe both the thermal effect and positive effect of strain rate on deformation-induced martensitic transformation. The new model reproduces the martensitic phase transformation behavior of quenching and partitioning sheet steels for a wide range of strain rate and temperature conditions well.

Keyword: *Quenching and partitioning, deformation induced martensitic transformation, temperature, strain rate, dynamic tensile test, transformation kinetics*

1. Introduction

As the increasing demands for lower vehicle weight and better passive safety, the application of Advanced High Strength Steel (AHSS) has greatly increased substantially in past few years. However, the unsatisfactory combination between strength and ductility of AHSS (like dual phase steels or martensitic steels) limited their further application in sheet metal forming. To overcome this phenomenon, a new concept called quenching and partitioning (QP) process was