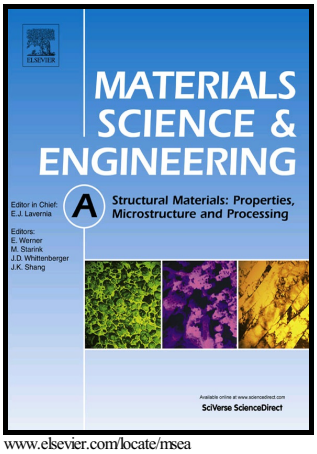
Microstructure-Mechanical Property Relationship and Austenite Stability in Medium-Mn TRIP steels: The Effect of Austenite-Reverted Transformation and Quenching-Tempering Treatments

Z.C. Li, H. Ding, R.D.K. Misra, Z.H. Cai



www.elsevier.com/locate/msea

PII: S0921-5093(16)31400-9
DOI: http://dx.doi.org/10.1016/j.msea.2016.11.048
Reference: MSA34374

To appear in: *Materials Science & Engineering A*

Received date: 20 October 2016
Revised date: 11 November 2016
Accepted date: 12 November 2016

Cite this article as: Z.C. Li, H. Ding, R.D.K. Misra and Z.H. Cai Microstructure-Mechanical Property Relationship and Austenite Stability in Medium-Mn TRIP steels: The Effect of Austenite-Reverted Transformation and Quenching-Tempering Treatments, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2016.11.048

Microstructure-Mechanical Property Relationship and Austenite Stability in Medium-Mn TRIP steels: The Effect of Austenite-Reverted Transformation and Quenching-Tempering Treatments

Z.C. Li[1,2], H. Ding[1*], R.D.K. Misra[2*], Z.H. Cai[1]

[1]School of Materials Science and Engineering, Northeastern University, Shenyang, 110819, China

[2]Laboratory for Excellence in Advanced Steel Research, Department of Metallurgical, Materials and Biomedical Engineering, University of Texas at El Paso, El Paso, TX 79968, USA

dinghuaneu@163.com

dmisra2@utep.edu

[*]Corresponding author:

Abstract

In the present study, we fundamentally explore the reasons underlying differences in mechanical properties in hot-rolled 0.2C-1.6Al-6.1Mn-Fe TRIP steels subjected to different heat treatments. Comparing with austenite reverted transformation annealing (ART) process, quenching and tempering (Q&T) process was effective in obtain excellent mechanical properties. [Q&T (UTS: 902-1235 MPa, TEL: 18-42%]; [ART (UTS: 885-945 MPa, TEL: 13-28%)]. In the ART process, long time annealing led to excessive C and Mn enrichment in austenite, which rendered austenite too stable and deteriorated TRIP effect. Furthermore, long time annealing reduced dislocation density and led to low work-hardening rate. The Q&T process enabled appropriate enrichment of elements and hence desired stability for significant TRIP effect to be observed. Thus, the steel quenched from 625℃ exhibited best combination of mechanical properties (UTS: 1038 MPa, TEL: 42%, UTS×TEL: 43.6 GPa%)