Effect of the stress state and strain rate on deformation-induced transformation in medium-Mn steels

Antonio Pontillo[a], Leo Kestens[a], Patricia Verleysen[a]

[a] *MST-DyMaLab Research Group, Department of Electromechanical, Systems and Metal Engineering, Faculty of Engineering and Architecture, Ghent University, Technologiepark 45, 9052 Zwijnaarde, Belgium*
[a]*Antonio.Pontillo@UGent.be*

The aim of present work is to investigate the combined influence of strain rate and stress state [1] on the stability of retained austenite in medium-Mn steels during plastic deformation. To this purpose, static and dynamic tensile tests are performed on cold rolled sheets of a 4Mn steel grade having three different initial microstructures obtained by a quenching and partitioning (Q&P), and two different intercritical annealing cycles. Next to a uniaxial dogbone tensile sample geometry, also a notched sample is used. The notched sample geometry is optimized using finite element modeling (FEM) aiming at high stress triaxialities. To have an estimation of the kinetics of the strain-induced transformation of the retained austenite, i.e., the TRIP effect, X-ray diffraction (XRD) measurements are performed on the undeformed sample and on the deformed sample (see Fig. 1b).

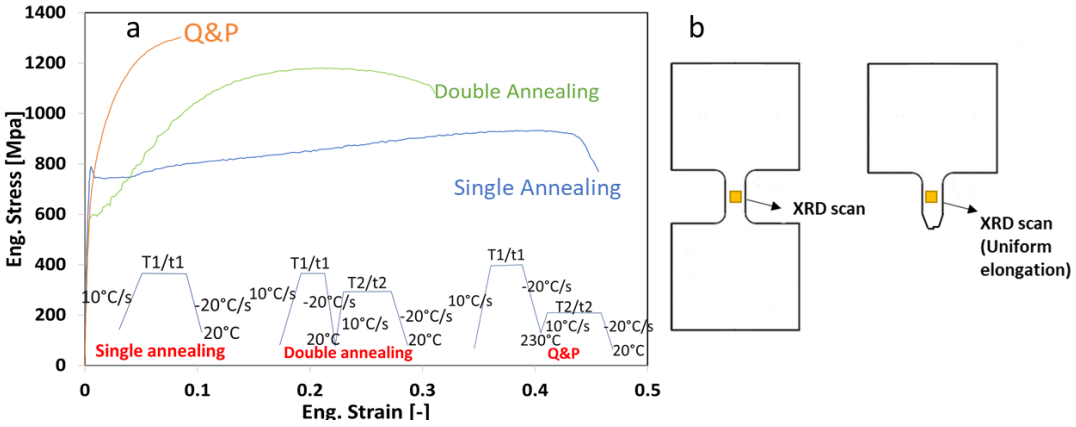

Fig. 1: a) Stress-strain engineering curves for three different heat treatments; b) location where the XRD scans are performed on the undeformed and deformed samples.

Keywords: medium-Mn steel, TRIP effect, high strain rate, stress triaxiality.

Acknowledgment: The authors gratefully acknowledge the financial support received from the European Union's RFCS program, project OptiQPap, No.899482.

References

[1] D. De Knijf et al. Factors influencing the austenite stability during tensile testing of quenching and partitioning steel determined via in-situ electron backscatter diffraction Materials Science and Engineering: A, *vol. 638, pp. 219–227 (2015).*