

Influence of the surface morphology on the cyclic deformation behavior of a high manganese TWIP steel

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The influence of the surface morphology on the cyclic deformation behavior and fatigue life of an austenitic, high-manganese TWinning Induced Plasticity (TWIP) steel (X40MnCrAl19-2, 1.7401) [1] were investigated. Therefore, specimens were manufactured by up- and down milling as well as polishing in addition to specimens with rolling skin representing the initial state. Differences in the surface morphology were characterized by confocal microscopy, SEM, FIB and XRD methods. Furthermore, differences in mechanical properties of the examined surface morphologies were characterized by cyclic indentation testing [2]. Stress controlled single step tests with a load ratio of $R = -1$ and frequencies of $f = 1$ Hz and $f = 2$ Hz were performed in the HCF regime at ambient temperature. Here, the cyclic deformation behavior was analyzed measuring the stress-strain hysteresis, temperature as well as electrical resistance [3]. The change of the electrical resistance (ΔR) as a function of the number of cycles shows an unexpected behavior. After initial increase, a decrease of ΔR up to an average of about 75% of fatigue life took place for most of the surface morphologies.

Keywords: TWIP steel; Surface morphology; Cyclic indentation; HCF; Cyclic deformation behavior; Electrical resistance

Acknowledgment: Funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project-ID 172116086 – SFB 926. The authors wish to thank thyssenkrupp Hohenlimburg GmbH for providing the steel 1.7401 and the chair MT&S of Prof. Seewig, for the possibility to use µsoft explorer.

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