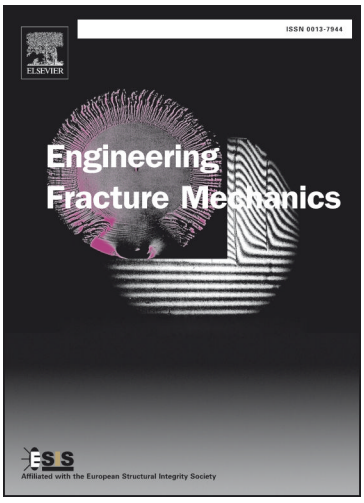

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PII: S0013-7944(18)30274-1
DOI: https://doi.org/10.1016/j.engfracmech.2018.06.022
Reference: EFM 6044

To appear in: *Engineering Fracture Mechanics*

Received Date: 12 March 2018
Revised Date: 18 June 2018
Accepted Date: 19 June 2018

Please cite this article as: Araujo Lage, M., de Figueiredo Cavalcante, D., Santos de Assis, K., Rosa Mattos, O., Evaluation of Fracture Toughness Test under Hydrogenation Condition and Microstructural Aspects using Unloading Compliance Technique, *Engineering Fracture Mechanics* (2018), doi: https://doi.org/10.1016/j.engfracmech.2018.06.022

Evaluation of Fracture Toughness Test under Hydrogenation Condition and Microstructural Aspects using Unloading Compliance Technique

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Abstract

Unloading compliance technique in fracture toughness tests according to ASTM E1820 standard is used to obtain the resistance curve (*R*-curve) of metallic materials in air tests. Even in this situation, there are aspects inherent to work hardening around the crack-tip that could affect the unloading compliance technique and that are not well discussed. .Another important aspect is the application of this methodology in conditions involving corrosive environments. Indeed, the presence of hydrogen around the crack-tip can promote significant changes in the strain and stress around the process zone, leading to the phenomenon called subcritical crack growth. This phenomenon can affect the compliance increasing the divergence between the crack sizes obtained by the unloading compliance technique and the correct crack sizes measured after the test. The aim of this paper is to analyse the influence of subcritical crack growth and to present a methodology to correct crack sizes and the influence of work hardening during fracture.

Keywords: Compliance method; R-Curves tests; crack growth; Stable Crack growth

Abbreviations

ASS	austenitic stainless
CMOD	crack mouth opening displacement
CTOD	crack tip opening displacement
EAC	environmentally assisted cracking
EBSD	electron backscattered diffraction
FCS	ferritic carbon steel
GTAW-P	gas tungsten arc welding pulsed
K	stress intensity factor
Kth	stress intensity factor threshold
PREN	pitting resistance equivalent number
SDSS	superduplex stainless steel
SENB	single edge notched bending