

## Accepted Manuscript

Mean stress sensitivity and crack initiation mechanisms of spring steel for torsional and axial VHCF loading

Herwig Mayer, Reinhard Schuller, Ulrike Karr, Michael Fitzka, Daniel Irrasch, Malte Hahn, Manfred Bacher–Höchst

PII: S0142-1123(16)30065-2

DOI: <http://dx.doi.org/10.1016/j.ijfatigue.2016.04.017>

Reference: JIJF 3933

To appear in: *International Journal of Fatigue*

Received Date: 29 January 2016

Revised Date: 7 April 2016

Accepted Date: 12 April 2016

Please cite this article as: Mayer, H., Schuller, R., Karr, U., Fitzka, M., Irrasch, D., Hahn, M., Bacher–Höchst, M., Mean stress sensitivity and crack initiation mechanisms of spring steel for torsional and axial VHCF loading, *International Journal of Fatigue* (2016), doi: <http://dx.doi.org/10.1016/j.ijfatigue.2016.04.017>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



## Mean stress sensitivity and crack initiation mechanisms of spring steel for torsional and axial VHCF loading

Herwig Mayer<sup>1\*</sup>, Reinhard Schuller<sup>1</sup>, Ulrike Karr<sup>1</sup>, Michael Fitzka<sup>1</sup>, Daniel Irrasch<sup>1</sup>,  
Malte Hahn<sup>2</sup>, Manfred Bacher-Höchst<sup>2</sup>

<sup>1</sup> Institute of Physics and Materials Science, BOKU, Peter-Jordan-Str. 82,  
A-1190 Vienna, Austria

<sup>2</sup> Robert Bosch GmbH, Corporate Sector Research and Advance Engineering, Materials  
and Process Engineering Metals, P.O. 300240, 70442 Stuttgart, Germany

\* Corresponding author: e-mail: herwig.mayer@boku.ac.at  
tel: +43 1 47654 5161  
fax: +43 1 47654 5159

### Abstract

The very high cycle fatigue (VHCF) properties of shot-peened VDSiCr spring steel have been investigated with the ultrasonic fatigue testing method. Fatigue behaviour under cyclic torsion and cyclic tension loading at load ratios between  $R = -1$  and  $R = 0.5$  is compared. For 90% of the VHCF failures under axial loading, fractured grain boundaries or inclusions in the interior of the material act as crack starters. In contrast, the initial crack is produced by cyclic shear in the interior or, less frequently, at the surface for more than 90% of the VHCF failures under torsional loading. The crack path deflects from mode II / mode III to mode I at the border of the initiating shear area. The change of crack path correlates to a stress intensity factor range for a crack loaded in shear mode of  $\Delta K_{t,ISA} = 5.6 \pm 0.5 \text{ MPam}^{1/2}$  for load ratio  $R = 0.1$  and  $\Delta K_{t,ISA} = 3.8 \pm 0.4 \text{ MPam}^{1/2}$  for  $R = 0.35$ , respectively. Residual stresses due to shot-

Download English Version:

<https://daneshyari.com/en/article/5015305>

Download Persian Version:

<https://daneshyari.com/article/5015305>

[Daneshyari.com](https://daneshyari.com)