

Accepted Manuscript

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PII: S0142-1123(17)30144-5

DOI: <http://dx.doi.org/10.1016/j.ijfatigue.2017.03.023>

Reference: JIJF 4286

To appear in: *International Journal of Fatigue*

Received Date: 4 February 2017

Revised Date: 16 March 2017

Accepted Date: 22 March 2017

Please cite this article as: Leitner, M., Tuncali, Z., Steiner, R., Grün, F., Multiaxial fatigue strength assessment of electroslag remelted 50CrMo4 steel crankshafts, *International Journal of Fatigue* (2017), doi: <http://dx.doi.org/10.1016/j.ijfatigue.2017.03.023>

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Multiaxial fatigue strength assessment of electroslag remelted 50CrMo4 steel crankshafts

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Abstract

This work investigates the fatigue strength of multiaxially-loaded gas engine crankshafts incorporating electroslag remelted 50CrMo4 steel. Uniaxial fatigue tests with small-scale round specimens before and after performing the ESR process are conducted. The results reveal that the high-cycle fatigue strength at the run-out region significantly decreases by 21 % if no ESR-treatment is performed. Multiaxial fatigue tests under proportional normal and shear stress loading demonstrate that the elliptical model by Gough and Pollard leads to a minor underestimation of 5 % compared to the test results. An application of several state-of-the-art equivalent stress hypotheses utilizing the critical plane approach is presented and the estimated results are compared to the experiments in terms of high-cycle fatigue resistance and crack initiation angle.

Keywords: Multiaxial fatigue; notch stress assessment; critical plane approach; equivalent stress concepts; electroslag remelting.

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