HIGH TEMPERATURE AXIAL STRAIN-CONTROLLED LCF/TMF FATIGUE TESTING OF FLAT-SHEET SPECIMENS

Klaus F. Staerk *

Strain controlled testing of flat-sheet specimens in low cycle fatigue (LCF) or thermal mechanical fatigue (TMF) needs special specimen design and equipment due to high test temperatures and stiffness in the compression part of the cycle.
There are some important requirements on such special equipment. The final solution is in use as a PC-controlled servohydraulic test rig for specimens with a thickness of 1mm down to 0.5 mm and a gauge length of 10mm. A susceptor of a single crystal material allows the heating of the specimen up to 1050°C and avoids buckling in the compression part of the cycle. Thin tiles of ZrO_2 reduce the friction between specimen and anti-buckling restraint. A twin induction heating device provides a homogeneous temperature distribution in the susceptor and the gauge length of the specimen.
The developed system permits the testing of flat sheet materials or samples cut out of thin-walled components in the original heat-treated, aged or post service condition.

INTRODUCTION

Standard low cycle fatigue (LCF) or thermal mechanical fatigue (TMF) testing of metallic materials requires thick plates or bars from which to cut cylindrical specimens with threaded ends or shoulders, s. Standards [1-5]. Many design configurations to be tested are thinner than the achieved diameters for the specimens, e.g. sheet materials, light weighted structures, welds (Zerbst and Kocak [6] and Cornec and Scheider [7]) or thin walled components. Cast or forged blanks with larger dimensions don't have the same material properties in reality. In special cases it is desired to test the same condition after heat treatment, forging, machining or coating process. These special requirements are the determining factor of the real properties of a component after operation. High temperature blades and vanes of Ni-based alloys are internally cooled and externally coated with high oxidation resisted overlays.

It was the aim of the current project to design and validate a specialist equipment

*Dr.-Ing Klaus F Staerk, ALSTOM (Switzerland) Ltd., Baden

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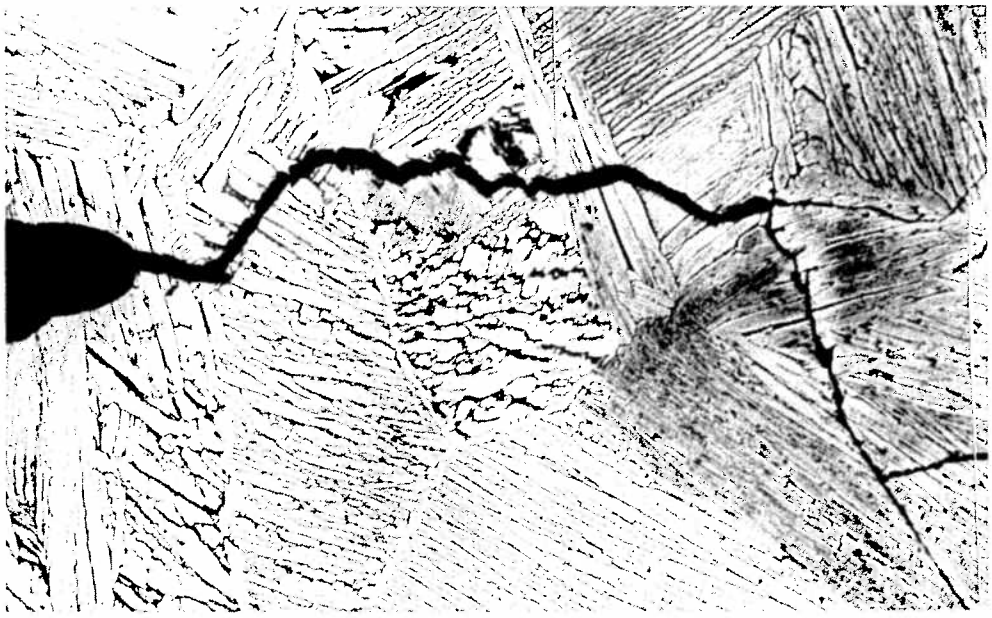

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M.R. Bache, P.A. Blackmore, J. Draper, J.H. Edwards, P. Roberts and J.R. Yates

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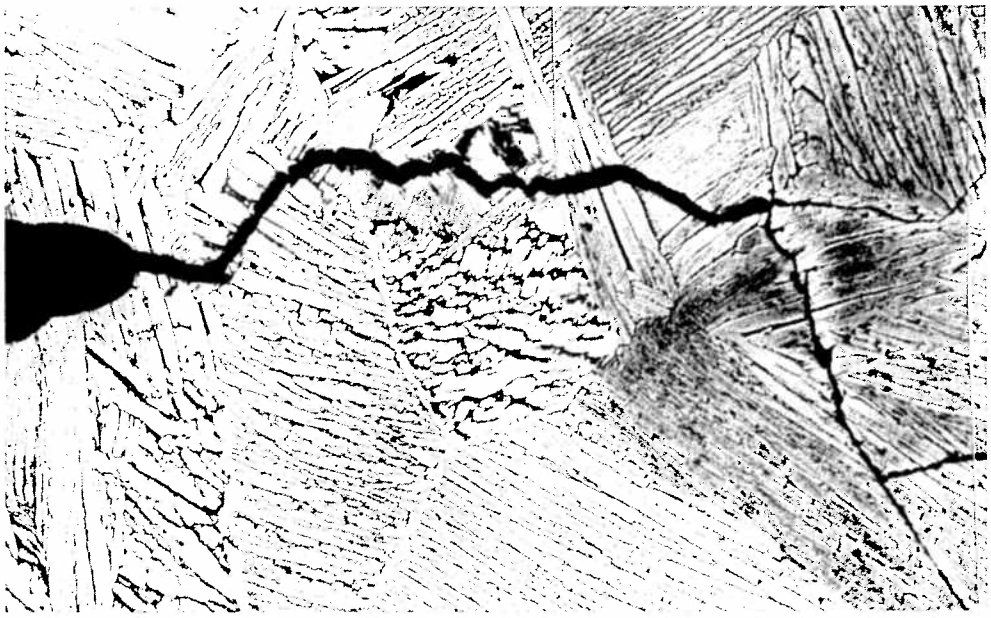

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