

Author's Accepted Manuscript

Micro-crack Initiation and Propagation in a High Strength Aluminum Alloy during Very High Cycle Fatigue

Luopeng Xu, Qingyuan Wang, Min Zhou



PII: S0921-5093(18)30008-X
DOI: <https://doi.org/10.1016/j.msea.2018.01.008>
Reference: MSA35962

To appear in: *Materials Science & Engineering A*

Received date: 1 November 2017
Revised date: 2 January 2018
Accepted date: 3 January 2018

Cite this article as: Luopeng Xu, Qingyuan Wang and Min Zhou, Micro-crack Initiation and Propagation in a High Strength Aluminum Alloy during Very High Cycle Fatigue, *Materials Science & Engineering A*, <https://doi.org/10.1016/j.msea.2018.01.008>

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 galley proof before it is published in its final citable 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.

Micro-crack Initiation and Propagation in a High Strength Aluminum Alloy during Very High Cycle Fatigue

Luopeng Xu^{a, b, c}, Qingyuan Wang^{b, d*}, Min Zhou^{b, c, d*}

^a *Department of Physics, Civil Aviation Flight University of China, Guanghan 618307, China*

^b *School of Aeronautics and Astronautics, Sichuan University, Chengdu 610064, China*

^c *The George W. Woodruff School of Mechanical Engineering, School of Materials Science and Engineering, Georgia Institute of Technology, Atlanta, Georgia 30332-0405, USA*

^d *School of Mechanical Engineering, Chengdu University, Chengdu 610106, China*

wangqy@scu.edu.cn (Q.Y. Wang),

min.zhou@gatech.edu (M. Zhou)

* Corresponding author.

ABSTRACT

The behavior of the new AA2198-T8 high strength aluminum alloy during tensile and very high cycle fatigue (VHCF) tests is studied. The results of the tensile tests show that the alloy in this heat treatment state has excellent mechanical properties compared with the same alloy with other heat treatment conditions and the 2024 and 7075 conventional aluminum alloys. The VHCF tests show a fatigue life plateau with the fatigue life reaching 10^9 cycles under a stress amplitude of 200 MPa, suggesting the existence of an endurance limit. Two different crack initiation modes are observed under scanning electron microscopy (SEM). Cracks tend to initiate from the interior of the specimen when fatigue life is in the VHCF regime. The interior crack initiation mode has a characteristic of a fish-eye, at the center of which is a white rough area (WRA) where the original micro-crack initiates. The thermo-mechanical process during ultrasonic fatigue is also studied. Quantitative analyses on micro-crack initiation and propagation show that the threshold stress intensity factor for stable micro-crack propagation is $1.66 \text{ MPa}\cdot\text{m}^{1/2}$, and the threshold stress intensity factor for unstable macro-crack propagation is $3.17 \text{ MPa}\cdot\text{m}^{1/2}$. Finally, analyses based on the Paris-Hertzberg law suggest that the micro-crack initiation stage likely consumes

Download English Version:

<https://daneshyari.com/en/article/7973674>

Download Persian Version:

<https://daneshyari.com/article/7973674>

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