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## 耐热钢GH36高低周复合疲劳裂纹扩展的研究

牛康民, 涂柏林, 颜鸣皋

北京航空材料研究所

### A STUDY OF LOW- AND HIGH-CYCLE COMBINED FATIGUE CRACK PROPAGATION FOR A SUPERALLOY GH36

Niu Kangmin, Tu Bailin, Yan Minggao

Institute of Aeronautical Materials, Beijing

摘要

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**摘要** 在600℃下进行了耐热钢GH36高低周复合疲劳裂纹扩展试验,观察到裂纹的 $da/dN$ 明显地分为两个区域:其一是慢速扩展区,此时裂纹扩展主要取决于低循环载荷;其二是快速扩展区取决于高频振动。两区之间存在一个明显的过渡点,约为 $\Delta K_{\text{minor}}=3.5\sim 5\text{MPa}\cdot\text{m}^{1/2}$ 。而高频振动载荷抑制蠕变损伤。因此高温高、低周复合疲劳存在着低周-蠕变-高频振动三者的交互作用。

**关键词:**

**Abstract:** In the past years, the low- and high-cycle combined fatigue (L-HCCF) testing has been studied by many investigators. However, the L-HCCF crack propagation behavior at elevated temperature has scarcely been reported. In this paper, the L-HCCF crack propagation behavior described by stress intensity factor at 600°C for a superalloy GH36 is presented. It was found that the rate of L-HCCF crack propagation per block,  $da/dN$ , appeared a f-shaped curve, may be divided into two regions: 1) the slow propagation region, where the crack propagation is dependent primarily on the damage induced by the low cycle fatigue load; 2) the fast propagation region, in which the vibration loading becomes a dominant factor. A transition point between two regions,  $K_{\text{minor}}=3.5\sim 5\text{MPa}\cdot\text{m}^{1/2}$ , can be explained with fatigue threshold value  $K_{\text{th}}(R)$ . The vibration loading appeared to restrain the creep damage at elevated temperature and an interaction among LCF, creep and HCF in the course of the L-HCCF crack propagation was noted, where the linear cumulative damage law was inapplicable.

**Keywords:**

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