王荣桥,荆甫雷,胡殿印.基于临界平面的镍基单晶高温合金疲劳寿命预测模型[J].航空动力学报,2013,28(11):2587~2592

基于临界平面的镍基单晶高温合金疲劳寿命预测模型

Fatigue life prediction model based on critical plane of nickel-based single crystal superalloy

投稿时间： 2012-11-04

DOI：

中文关键词： 镍基单晶高温合金 寿命预测 疲劳 黏塑性 临界平面 循环损伤累积

英文关键词:nickel-based single crystal superalloy life prediction fatigue viscoplastic critical plane cyclic damage accumulation

基金项目:

作者	单位
王荣桥	北京航空航天大学 能源与动力工程学院，北京 100191
荆甫雷	北京航空航天大学 能源与动力工程学院，北京 100191
胡殿印	北京航空航天大学 能源与动力工程学院，北京 100191

中文摘要:

根据循环损伤累积的思想,发展了一种基于临界平面的镍基单晶高温合金疲劳寿命预测模型.以非弹性应变能密度最大的滑移面作为镍基单晶高温合金承受最大损伤的临界平面,并结合基于滑移系的黏塑性变形分析结果,建立了疲劳寿命与最大滑移系分解剪应力、最大滑移剪应变率、滑移剪应变范围、应变比以及拉伸/压缩保载频率等临界平面参数的函数关系.采用760℃下DD6单晶的疲劳试验结果对上述预测模型进行验证,试验与计算结果符合良好,基本在2倍分散带内.

英文摘要:

A model was developed for fatigue life prediction of nickel-based single crystal superalloy based on critical plane and cyclic damage accumulation.The slip plane with the maximum inelastic strain energy density was chosen as the critical plane of nickel-based single crystal superalloy which was subjected to the most serious damage.Based on the results of viscoplastic deformation analysis on slip systems,the relation between the fatigue life and the parameters of the critical plane such as the maximum resolved shear stress,the maximum shear strain rate due to slip,shear strain range due to slip,strain ratio and the tension/compression dwell frequency,was formulated.The life prediction method was validated with the fatigue testing results of DD6 at 760℃.The experiments agree well with the calculations,and almost all of the results fall in the scatter band of 2.

查看全文 查看/发表评论 下载PDF阅读器