

反应堆工程

350 °C下长期时效对17-4PH不锈钢动态断裂韧性的影响

王均¹, 邹红², 伍晓勇², 杨宏山¹, 邱绍宇², 沈保罗¹

1.四川大学 材料科学与工程学院, 四川 成都 610064

2.中国核动力研究设计院, 四川 成都 610041

收稿日期 2004-9-1 修回日期 2005-1-9 网络版发布日期: 2006-10-17

摘要 利用示波冲击试验系统研究反应堆用17-4PH马氏体不锈钢在使用温度(350 °C)下长期(约11 000 h)时效过程冲击性能和动态断裂韧度的变化规律,并用扫描电镜观察分析不同时效时间的Charpy V型缺口试样(CVN)的断口形貌。结果表明:该马氏体不锈钢在350 °C长期时效的过程中,随着时效时间的延长,其塑性变形能 E_p 和撕裂能 E_{TE} 以及冲击功 E_t 均随时效时间的延长而逐渐下降。根据示波冲击曲线获得了该钢的动态断裂韧度 K_{Id} ,其动态断裂韧度也随时效时间的延长而逐渐下降,并在试验的初始阶段下降很快,在试验的中后期下降较为缓慢。另外,该不锈钢的CVN冲击试样断口形貌随着时效时间的延长由韧性断裂机制的韧窝断裂为主向脆性断裂机制的准解理断裂和穿晶断裂为主变化。这些均说明,随着时效时间的延长,该材料的韧性降低,发生了脆化,且脆化主要发生在试验的初始阶段。

关键词 [17-4PH不锈钢](#); [等温时效](#); [示波冲击实验](#); [动态断裂韧度](#); [冲击断口剪切面积百分比](#)

分类号 [TL359.6](#)

Effect of Long-Term Aging at 350 °C on Dynamic Fracture Toughness of 17-4PH Stainless Steel

WANG Jun¹, ZOU Hong², WU Xi ao-yong², YANG Hong-shan¹, QIU Shao-yu², SHE N Bao-luo¹

1. School of Materials Science and Engineering, Sichuan University, Chengdu 610064, China;

2. Nuclear Power Institute of China, Chengdu 610041, China

Abstract The variation of impact performance with the extension of aging time on the type of 17-4PH stainless steel at 350 °C was studied in the paper, and the variation of dynamic fracture toughness and fractography of the type stainless steel for various holding time at this temperature were also researched by instrumental impact test and scanning electron microscope. All results indicate that the plastic deformation energy (E_{pL}), tearing energy (E_{TE}), absorbed in fracture energy (E_t) and dynamic fracture toughness (K_{Id}) of this type alloy are decreased with the continuation of time at 350 °C. The K_{Id} falls fast at the forepart of aging test and then slowly. It shows that the toughness of the alloy is degraded and the degradation is mainly taken place at the forepart of aging test. The fractography of this alloy is changed from dimple fracture into cleavage fracture and inter granular rupture with the extension of aging time. Those show that the fracture toughness of this alloy has degraded with the extension of aging time at 350 °C.

Key words [17-4PH stainless steel](#) _ [isothermal aging](#); [instrumental impact test](#); [dynamic fracture toughness](#); [percentage of shear fracture](#)

DOI

扩展功能

本文信息

► [Supporting info](#)

► [\[PDF全文\]\(187KB\)](#)

► [\[HTML全文\]\(0KB\)](#)

► [参考文献](#)

服务与反馈

► [把本文推荐给朋友](#)

► [文章反馈](#)

► [浏览反馈信息](#)

相关信息

► [本刊中 包含“17-4PH不锈钢; 等温时效; 示波冲击实验; 动态断裂韧度; 冲击断口剪切面积百分比”的 相关文章](#)

► 本文作者相关文章

- [王均](#)
- [邹红](#)
- [伍晓勇](#)
- [杨宏山](#)
- [邱绍宇](#)
- [沈保罗](#)

