

## 水化学和腐蚀温度对锆合金氧化膜中压应力的影响

上海大学 材料研究所, 上海 200072

## Effect of Water Chemistry and Corrosion Temperature on Compressive Stress of Oxide Films on Zirconium Alloys

Institute of Materials Science, Shanghai University, Shanghai 200072, China

- [摘要](#)
- [参考文献](#)
- [相关文章](#)

Download: PDF (1113KB) [HTML](#) (1KB) Export: BibTeX or EndNote (RIS) [Supporting Info](#)

**摘要** 不同水化学条件下,对Zr-4和N18管状样品进行腐蚀实验,然后用氧化膜卷曲法测量腐蚀样品氧化膜中的压应力,研究腐蚀温度、水化学对氧化膜中压应力随厚度变化的影响规律.实验结果表明,Zr-4和N18样品氧化膜中的压应力均按360℃去离子水>400℃过热蒸汽>360℃LiOH水溶液的顺序依次减小.在360℃LiOH水溶液中腐蚀时,氧化膜中的压应力最低,这与Li<sup>+</sup>和OH<sup>-</sup>会渗入氧化膜,降低氧化锆表面自由能,从而加速氧化膜中空位的扩散凝聚、孔隙的形成和微裂纹发展的过程有关.高温使空位的扩散加快,促进了氧化膜中压应力的弛豫过程.

**关键词:** [锆合金](#); [耐腐蚀性能](#); [氧化膜](#); [压应力](#)

**Abstract:** To investigate the effect of corrosion temperature and water chemistry on compressive stress with the increase of oxide film thickness, Zr-4 and N18 tubular specimens were corroded in three kinds of water chemistry. Compressive stress of oxide films formed on the outside of the tubular specimens was measured with a curling method of oxide film. Experimental results indicate that compressive stress in oxide films decreases in the sequence of 360℃ deionized water >400℃ super-heated steam >360℃ lithiated water. Li<sup>+</sup> and OH<sup>-</sup> ions incorporated into the oxide films decrease the surface free energy of oxide. As a result, the diffusion of vacancies, formation of pores and development of micro-cracks are enhanced. This is the reason why compressive stress of oxide films formed in 360℃ lithiated water is the lowest. Diffusion of vacancies is promoted at higher temperature, resulting in relaxation of compressive stress in oxide films. Therefore compressive stress of oxide films formed in 400℃ super-heated steam is lower than that formed in 360℃ deionized water.

**Keywords:**

收稿日期: 2009-12-05;

基金资助:

国防科技重点实验室基金资助项目(9140C7004010803);上海市重点学科建设资助项目(S30107)

通讯作者 周邦新(1935~),男,教授,中国工程院院士,博士生导师,研究方向为核反应堆用锆合金. E-mail: zhoubx@shu.edu.cn

作者简介: 周邦新(1935~),男,教授,中国工程院院士,博士生导师,研究方向为核反应堆用锆合金. E-mail: zhoubx@shu.edu.cn

引用本文:

耿建桥,周邦新,姚美意等.水化学和腐蚀温度对锆合金氧化膜中压应力的影响[J].上海大学学报(自然科学版),2011,V17(3):293-296

GENG Jian-Qiao, ZHOU Bang-Xin, YAO Mei-Yi etc. Effect of Water Chemistry and Corrosion Temperature on Compressive Stress of Oxide Films Zirconium Alloys[J]. J. Shanghai University (Natural Science Edition), 2011, V17(3): 293-296

链接本文:

<http://www.journal.shu.edu.cn//CN/10.3969/j.issn.1007-2861.2011.03.016> 或 <http://www.journal.shu.edu.cn//CN/Y2011/V17/I3/293>

没有本文参考文献

[1] 周小玲.回顾、审视与展望——对中国电影类型研究的思考[J].上海大学学报(自然科学版),2011,18(5):51-60

[2] 祁志祥.善恶观:可欲为善、公意为善[J].上海大学学报(自然科学版),2011,18(5):71-78

## Service

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [Email Alert](#)
- ▶ [RSS](#)

## 作者相关文章

- ▶ [耿建桥](#)
- ▶ [周邦新](#)
- ▶ [姚美意](#)
- ▶ [王锦红](#)
- ▶ [张欣](#)
- ▶ [李士炉](#)
- ▶ [杜晨曦](#)

- [3] 李隆虎.食与权：“大跃进”时期粮食流转体制的研究——以贵州省北碚地区为例[J].上海大学学报(自然科学版),2011,31(5):158-189
- [4] 周潇.反学校文化与阶级再生产：“小子”与“子弟”之比较[J].上海大学学报(自然科学版),2011,31(5):70-92
- [5] 林晓珊.母职的想象：城市女性的产前检查、身体经验与主体性[J].上海大学学报(自然科学版),2011,31(5):133-157
- [6] 孙明.家庭背景与干部地位获得（1950-2003）[J].上海大学学报(自然科学版),2011,31(5):48-69
- [7] 潘天舒,洪浩瀚.上海“麦工”意义世界的人类学解读——基于田野体验的视角与洞见[J].上海大学学报(自然科学版),2011,31(5):93-113
- [8] 黄盈盈,王文卿,潘绥铭.男民工与阶层、社会性别、性的主体建构[J].上海大学学报(自然科学版),2011,31(5):114-132
- [9] 吴帆.中国老年歧视的制度性根源与老年人公共政策的重构[J].上海大学学报(自然科学版),2011,31(5):190-206
- [10] 陈珩.超越嵌入性范式：金融社会学的起源、发展和新议题[J].上海大学学报(自然科学版),2011,31(5):207-225