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论文

Pd粉及$Pd_{91.31}Y_{8.50}Ru_{0.19}$合金膜的氚老化效应

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摘要:

为了解Pd及其合金贮氚(T)老化后, ^3He在材料中的存在形式及分布状态, 利用XRD与TEM分别分析了贮T老化1.6和3.5 a的Pd粉, 以及贮T老化41和295 d的$Pd_{91.31}Y_{8.50}Ru_{0.19}$合金膜的结构变化. 结果表明: T老化使得Pd粉的XRD峰变宽且峰强降低, 晶格发生畸变, 同时, 衍射峰略向低角度偏移, 晶格发生膨胀, 1.6和3.5 a老化后, 晶格常数分别增加0.095%和0.11%; 在老化41 d的$Pd_{91.31}Y_{8.50}Ru_{0.19}$合金膜中, 观察到分布均匀、直径约为1 nm的He泡, 同时存在高密度的位错及位错环, 在老化295 d的样品中, He泡直径略微增加, 达1.2-1.4 nm, 且分布均匀, 位错及位错环密度降低.

关键词: Pd $Pd_{91.31}Y_{8.50}Ru_{0.19}$ 氚老化 ^3He He泡

AGING EFFECTS OF TRITIUM ON Pd POWDERS AND $Pd_{91.31}Y_{8.50}Ru_{0.19}$ ALLOY FILM

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Abstract:

During tritium (T) treatment, Pd and its alloys will be aged due to solution of ^3He, a product of T decay, in lattices, which changes the microstructure and properties of the materials. The existing and distributing states of 3He in Pd and $Pd_{91.31}Y_{8.50}Ru_{0.19}$ alloy during T aging were studied by XRD and TEM. XRD results for Pd powders aged up to 1.6 and 3.5 a show that the peaks widen, intensities of peaks reduce and lattice constants incease by 0.095% and 0.11%, respectivey. TEM observtions show thaabout 1 nm sized He bubbls appear n $Pd_{91.31}Y_{8.50}Ru_{0.19}$ alloy aged for 41 d, nd more dislocaions and dislocation loops arobserved; after 295 d aging, the He bubbles grow slightly and reach 1.2—1.4 nm in diameter, but the amounts of dislocations nd dslocation loops decrease.

Keywords: Pd $Pd_{91.31}Y_{8.50}Ru_{0.19}$ tritium aging ^3He He bubble

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参考文献:

[1] Hu Z L. Hydrogen Storage Material. Beijing: Chemical Industry Press, 2002: 32
(胡子龙. 贮氢材料. 北京: 化学工业出版社, 2002: 32)

[2] Lasser R. Tritium and Helium–3 in Metals. Berlin: Spring–Verlag, 1989: 34, 109
[3] Wileman R C J, Harris I R. J Less–Common Met, 1985; 109: 367
[4] Suzuki Y, Kimura S. Nucl Technol, 1993; 103: 93
[5] Luo D L, Shen C S, Meng D Q. Fusion Sci Technol, 2002; 41: 1142
[6] Evans J, Harris I R. J Less–Common Met, 1983; 89: 407
[7] Abell G C, Matson L K, Steinmeyer R H. Phys Rev, 1990; 41B: 1220
[8] Fabre A, Decamps B, Finot E, Penission J M, Demoment J, Thiebaut S, Contreras S, Percheron–Guegan A. J Nucl Mater, 2005; 342: 101
[9] Klevtsov V G, Boitsov I E, Vedeneev A I, Glagolev M V, Lobanov V N, Malkov I L, Pimanikhin S A, Stengach A V. Fusion Eng Des, 2000; 49–50: 873
[10] Tebus V, Rivkis L, Dmitrievskaia E, Arutunova G, Golikov I, Ryazantseva N, Filin V, Kapychev V, Bulkin V. J Nucl Mater, 2002; 307–311: 966
[11] Thiebaut S, Paul–Boncour V, Percheron–Gu´egan A, Limacher B, Blaschko O, Maaier C, Tailland C, Lerov D. Phys Rev, 1998; 57B: 10379
[12] Thomas G J, Mintz J M. J Nucl Mater, 1983; 116: 336
[13] Thiebaut S, Decamps B, P´enisson J M, Limacher B, Percheron–Guegan A. J Nucl Mater, 2000; 277: 217
[14] Wang P X, Song J S. Helium in Materials and the Permeation of Tritium. Beijing: National Defense Industry Press, 2002: 3
(王佩璇, 宋家树. 材料中的氦及氚的渗透. 北京: 国防工业出版社, 2002: 3)
[15] Wang L B, Lu M Q, Li Y Y. Acta Metall Sin, 2003; 39: 449
(王隆保, 吕曼祺, 李依依. 金属学报, 2003, 39: 449)

本刊中的类似文章

1．李猛进, 孙晓峰, 管恒荣, 姜晓霞, 胡壮麒 .(Ni, Pd)Al涂层的高温热腐蚀[J]. 金属学报, 2004,40(7): 773-778
2．秦凤香, 张海峰, 李宏 .Zr55Al10Cu30Ni5-xPdx块状非晶合金的玻璃形成能力和热稳定性[J]. 金属学报, 2003,39(3): 305-309
3．李猛进, 孙晓峰, 管恒荣 .Pd-Ni-Al涂层的高温长期氧化行为[J]. 金属学报, 2003,39(7): 755-760
4．张文魁, 黄辉, 甘永平 .Pd/Y薄膜在气态吸放氢过程中的表面形貌和可转换光学特性[J]. 金属学报, 2003,39(9): 974-978
5．田青超, 吴建生 .Ti50+xPd30Ni20-x高温形状记忆合金的弹性行为[J]. 金属学报, 2001,37(6): 658-662
6．齐卫宏 .Pd纳米微粒的晶格参数和结合能的尺寸形状效应研究[J]. 金属学报, 2006,42(10): 1065-1070
7．曹为民, 陈浩, 石新红, 朱律均, 姬学彬, 张磊 , 印仁和 .Co/Pd纳米多层膜的制备及其磁性能[J]. 金属学报, 2008,44(4): 445-450
8．王雨晨 .FCC金属钯中晶内滑移和晶界滑移的研究[J]. 金属学报, 2008,44(3): 257-262
9．孔凡荣 张海鸥 王桂兰.等离子沉积直接成形传热传质与晶粒生长多尺度数值模拟[J]. 金属学报, 2009,45(4): 415-421
10．黄火根 贾建平 李嵘.Pd替代对Ti-Zr-Ni准晶合金结构的影响[J]. 金属学报, 2009,45(10): 1272-1276

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