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铁腐蚀产物对铁白铜传热管腐蚀影响试验研究

摘要

铁白铜以其出色的耐腐蚀性和热交换效率，广泛应用于核动力装置的海水换热系统，但近年来在使用中也发生了多起铁白铜传热管腐蚀泄漏问题。通过传热管失效分析，发现热管表面附着了大量铁腐蚀产物，可能是导致传热管腐蚀泄漏的原因。本文通过实验室内合成铁腐蚀产物，模拟核动力装置水质环境，开展了铁腐蚀产物对铁白铜传热管腐蚀影响实验研究。实验结果证明在海水中，当致密铁腐蚀产物层吸附于铁白铜表面时，其在边界处对铁白铜具有一定的腐蚀促进作用；当多孔铁腐蚀产物层吸附于铁白铜表面时，其对铁白铜表面产生垢下腐蚀作用，经过 30 天浸泡后，腐蚀坑深度达到 102μm，以此推算深度腐蚀速率为 1.24mm/a。

关键词

铁白铜；铁腐蚀产物；垢下腐蚀

Abstract

Iron white copper (often referred to as cupronickel) is extensively utilized in the seawater heat exchange systems of nuclear power installations owing to its superior corrosion resistance and thermal efficiency. However, in recent years, numerous cases of corrosion-induced leakage in these heat transfer tubes have been reported during operation.Failure analysis revealed that a significant accumulation of iron corrosion products adhered to the tube surfaces, suggesting these deposits as the probable cause of the leaks. This study investigates the impact of these products on the corrosion behavior of iron white copper tubes by synthesizing iron corrosion products in the laboratory and simulating the water chemistry environment of nuclear power facilities.
Experimental results demonstrate that in a seawater environment:When a dense layer of iron corrosion products adheres to the surface, it promotes corrosion at the boundaries.
When a porous layer adheres, it induces under-deposit corrosion.After 30 days of immersion, the corrosion pit depth reached 102 μm, which extrapolates to a deep penetration corrosion rate of 1.24 mm/a.

Keywords

Iron white copper (BFe) ；Iron corrosion products；Under-deposit corrosion

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