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甲烷对 **Inconel 617** 和 **Incoloy 800H** 腐蚀和拉伸行为的研究

摘要

本文研究了 Inconel 617 和 Incoloy 800H 两种合金在 950℃ 下含有不同浓度甲烷（50、100、400 ppm）的氦气气氛中分别腐蚀 50、100、200 h 后的渗碳行为和拉伸行为。结果表明，Inconel 617 和 Incoloy 800H 在含 50 和 100 ppm 甲烷的氦气中腐蚀 50、100、200 h 后的微观结构变化不大，只在合金表面发生了微弱的氧化和渗碳。在含 400 ppm 甲烷的氦气中腐蚀 200 h 后，Inconel 617 在晶粒内部析出了大量的碳化铬和碳化钼。晶内渗碳引起了 Inconel 617 的脆性沿晶断裂，大幅降低了合金的极限抗拉强度和延伸率。而 Incoloy 800H 只在晶界处析出了碳化铬，引起合金发生了脆性穿晶断裂。晶界渗碳降低了 Incoloy 800H 的延伸率，但不影响极限抗拉强度。

关键词

超高温气冷堆、镍基合金、渗碳行为、拉伸行为、痕量甲烷

Abstract

This paper investigates the carburization and tensile behavior of Inconel 617 and Incoloy 800H after exposure to helium containing different methane concentrations (50, 100, and 400 ppm) at 950℃ for 50, 100, and 200 hours. Results indicate minimal microstructural changes for both alloys after exposure to 50 and 100 ppm methane, with only slight surface oxidation and carburization. After 200 hours of exposure to helium containing 400 ppm methane, Inconel 617 exhibited substantial intragranular precipitation of chromium and molybdenum carbides. Intragranular carburization leads to brittle intergranular fracture, significantly reducing the ultimate tensile strength and elongation of Inconel 617. In contrast, Incoloy 800H showed chromium carbide precipitation primarily at the grain boundaries, resulting in brittle transgranular fracture. Intergranular carburization reduces the elongation of Incoloy 800H but does not affect its ultimate tensile strength.

Keywords

Very-High-Temperature Gas-Cooled Reactor, Ni-based alloy, Carburization behavio, Tensile properties, Gas corrosion on the ppm scale

Author: 斌, 杜 (清华大学核研院)

Co-author: 华强, 银

Presenter: 斌, 杜 (清华大学核研院)

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