Microstructural characterization of Ni-201 weld cladding onto 304 stainless steel

Xianwu Shi, Kun Yu, Li Jiang, Chaowen Li, Zhijun Li, Xingtai Zhou

PII: S0257-8972(17)31160-X
DOI: doi:10.1016/j.surfcoat.2017.11.023
Reference: SCT 22871

To appear in: *Surface & Coatings Technology*

Received date: 21 July 2017
Revised date: 6 November 2017
Accepted date: 8 November 2017

Please cite this article as: Xianwu Shi, Kun Yu, Li Jiang, Chaowen Li, Zhijun Li, Xingtai Zhou , Microstructural characterization of Ni-201 weld cladding onto 304 stainless steel. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2017), doi:10.1016/j.surfcoat.2017.11.023

Microstructural characterization of Ni-201 weld cladding onto 304 stainless steel

XianwuShi[1,2], Kun Yu[1,2], Li Jiang[1], Chaowen Li[1],Zhijun Li[1]*,Xingtai Zhou[1]

[1]Center for Thorium Molten Salt Reactor System,Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Shanghai 201800, China

[2] University of Chinese Academy of Sciences, Beijing 100049, China

∗ Corresponding author : Thorium Molten Salts Reactor Center, Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Shanghai 201800, China; Email: lizhijun@sinap.ac.cn (Li Zhijun); Tel./Fax: +86-2139194767

Abstract

Ni-201(ERNi-1), a cladding layer which is resistant to the corrosion of molten salts, was deposited on 304SS substrate by Gas Tungsten Arc Welding (GTAW). Microstructure characterization showed that the cladding interface was obviously divided into three zones from microstructures along depth, weld metal (WM), unmixed zone (UZ) and heat affected zone (HAZ). Element distribution presented that elements Ti, N, Si were segregated into interdendritic region of WM and formed the TiN precipitates during the solidification. The element distribution of UZ was similar to that of HAZ. A large quantity of vermicular δ-ferrite phases were precipitated in laminar UZ. Grain coarsening in HAZ was evident compared with the grains in base metal, and no precipitates were found in HAZ. The hardness of cladding layers was decreased from interface to surface. The cladding layer exhibited excellent corrosion resistance to molten FLiNaK salts.

Keywords: Gas Tungsten Arc Welding (GTAW); Microstructure; Interface; Precipitates; δ-ferrite; Hardness; Corrosion resistance

1. Introduction

Molten salt reactor (MSR) is the only reactor made use of high temperature molten salts as fuels and coolants among the fourth generation nuclear energy systems. MSR possesses a large quantity of advantages such as uncomparable safety, simple and flexible fuel cycle in operation, better fission fuels utilization, 40%-50% power generation efficiency, hydrogen by product at high temperature and so on [1]. In recent years, the development of MSR has attracted more and more attention from the international nuclear communities [2-4].