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Claire Boulesteix, Fernando Pedraza

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Characterisation of Aluminium Diffusion Coatings Elaborated on Austenitic Stainless Steels and on Ferritic-Martensitic Steels

Claire Boulesteix, Fernando Pedraza

Laboratoire des Sciences de l'Ingénieur pour l'Environnement (LaSIE, UMR-CNRS 7356), Université de La Rochelle, Avenue Michel Crépeau, 17042 La Rochelle Cedex 1, France

claire.boulesteix@univ-lr.fr ; fernando.pedraza@univ-lr.fr

Abstract. Slurry aluminide coatings were elaborated on IN-800HT and HR3C austenitic stainless steels (ASS) and on P92 ferritic-martensitic steels. The thermal treatments conducted in Ar enabled the melting of Al and the high temperature synthesis with the substrate elements to result in an aluminium diffusion coating. Whether for the ferritic-martensitic or the austenitic stainless steels, the coatings were formed by the simultaneous Al inward diffusion into the steel matrix and the outward diffusion of Fe (and Ni for the ASS) on both steel substrates. As a result, the coatings exhibited a B2-(Fe,Ni)Al phase for the ASS and B2-FeAl phase for the P92 substrate. A reduction of the grain size after annealing was noticed for the ASS but their microstructures remained mostly austenitic. However, a significant increase of the grain size occurred in the P92 steel with a transformation from the initial tempered martensitic structure to an austenitic structure. The microhardness of the ASS did not change significantly whereas for P92, a large increase occurred.

Keywords: Austenitic steels, Ferritic-martensitic steels, Aluminium diffusion coatings, Characterisation.

1. INTRODUCTION

In order to achieve higher efficiencies and to decrease the CO_2 emissions in the power generation industry, the operating temperatures and pressures have to be increased [1, 2]. The new generation of ultra-supercritical power plants (USC units) operate with steam temperatures up to 600-650°C and pressures from 25 to 30 MPa [3, 4]. In these plants, austenitic stainless steels are commonly employed in superheaters and reheaters of steam boilers whereas ferritic martensitic steels are preferred for larger components like tubes and pipes [5-7]. Due to their high temperature oxidation and corrosion resistance combined with their high strength, the HR3C and the IN-800HT austenitic stainless steels (ASS) can be employed in USC units [8, 9]. With a density of 8 $mg.cm^{-3}$, IN-800HT is a modified version

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