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PII: S0257-8972(17)30020-8
DOI: doi: 10.1016/j.surfcoat.2017.01.020
Reference: SCT 21996

To appear in: *Surface & Coatings Technology*

Received date: 8 September 2016
Revised date: 23 December 2016
Accepted date: 6 January 2017

Please cite this article as: L.F. Hu, J. Li, Y.F. Tao, Y.H. Lv , Corrosion behaviors of TiNi/Ti2Ni matrix coatings in the environment rich in Cl ions. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2017), doi: 10.1016/j.surfcoat.2017.01.020

Corrosion behaviors of TiNi/Ti_2Ni matrix coatings in the environment rich in Cl ions

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Abstract

The TiNi/Ti_2Ni matrix coatings were fabricated on Ti6Al4V by laser cladding. The effects of TaC on corrosion behavior of the coatings in 0.1 mol/L HCl were investigated. The coatings mainly consisted of TiNi/Ti_2Ni (the matrix) and TiB/TiB_2/TiC (the ceramic reinforcement). Corrosion resistance of the coatings was significantly increased when compared with that of the substrate. The average values of corrosion potential (E_{corr}) and reaction resistance (R_{ct}) were increased to −0.25 V and 3.79E6 Ω·cm^2 (−0.42 V and 1.26E4 Ω·cm^2 for the substrate), and the average passive current density (I_p) was reduced to 8.93E−6 A/cm^2 (1.03E−4 A/cm^2 for the substrate). Moreover, the coatings were more difficult to be broken down than the substrate resulting from the formation of SiO_2 and Ta_2O_5 (especially the latter). The average values of breakdown potential (E_{bp}) and pitting resistance (R_{pit}) were enhanced to 0.12 V and 2.21E5 Ω·cm^2 (−0.12 V and 1770 Ω·cm^2 for the substrate). Corrosion resistance of the coatings was further improved by adding TaC into the cladding material because of the formation of Ta_2O_5 on the surfaces of the coatings, including the increase in reaction resistance and the retardation in passive film breakdown. The immersion tests further confirmed this.

***Keywords*:** laser cladding, coating, microstructure, corrosion behavior, oxidation film

1. Introduction

Titanium alloy is known for its excellent corrosion resistance in a variety of industrial fields, such as in navigation, petrochemical industries, medical apparatus, and lining of the chimney [1,2]. The excellent corrosion

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