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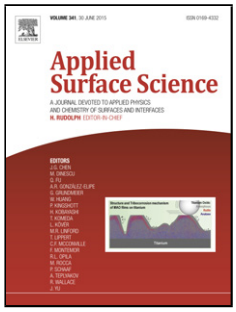

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Corrosion behavior of HVOF sprayed hard face coatings in alkaline-sulfide solution

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Highlights

- The corrosion behavior of three HVOF coatings in alkaline-sulfide was investigated.
- Cr improves the corrosion resistance of WC-based coating and Cr_3C_2-NiCr is the best.
- Cr_3C_2-NiCr shows the longest passive region and lowest I_{corr} in alkaline-sulfide.

Abstract:

The paper focuses on the corrosion behavior of high velocity oxygen fuel (HVOF) sprayed WC-17Co, WC-10Co-4Cr, Cr_3C_2-25NiCr coatings in alkaline-sulfide solution (S^{2-}, 0.2ml/L, pH=10). Eighteen days of immersion test is carried out and corrosion rate analysis shows that the Cr_3C_2-NiCr coating of low porosity exhibits the best corrosion resistance. In alkaline-sulfide solutions, porosity, passive film and microgalvanic between hard phase and binder phase have significant effect on the corrosion behavior of coatings. The corrosion mainly occurs in binder phase from SEM, though WO_3, WS_2, Cr_2S_3 are detected in XPS. In WC-17Co coating, the binder phase Co transforms to Co oxides and serious corrosion can be observed in binder phase. WC-10Co-4Cr coatings suffer localized corrosion since galvanic corrosion occurs between locations with different solubilities of W in Co binder. Cr_3C_2-25NiCr coating shows slight corrosion with the formation of NiS/Ni2O3/Cr2O3from the binder and Cr_2S_3 from the hard phase.. The results are verified by the polarization curves, which show the longest passive region and lowest $I_{corrosion}$ of Cr_3C_2-25NiCr coating.

Keywords: HVOF; Hard face coatings; Corrosion behavior; Alkaline-sulfide solution

1. Introduction

HVOF technology is widely used in surface engineering due to its unique advantages. The HVOF process is characterized by high velocity of particles and relatively low temperature, which lead to better bond strength, lower porosity and lower degree of decarburization compared to other thermal spraying techniques [1-3].

The WC-based and Cr_3C_2-based hard face coatings are generally produced by HVOF to obtain great cohesion and adhesion with substrates. These coatings exhibit an excellent combination of high hardness, wear and corrosion resistance [4,5], which are now being specified for critical application in industry components such as shaft sleeves, oil pipelines and chemical containers [6]. The erosion-corrosion resistance of HVOF sprayed WC-17Co coatings on AISI 1018 steel was studied by Saha et al. [7]. The combined erosion-corrosion resistance of WC-17Co coatings was

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