Supplementary Material

Electrochemical Corrosion Behavior of Fe_3Al /TiC and Fe_3Al-Cr/TiC Coatings Prepared by HVOF in NaCl Solution

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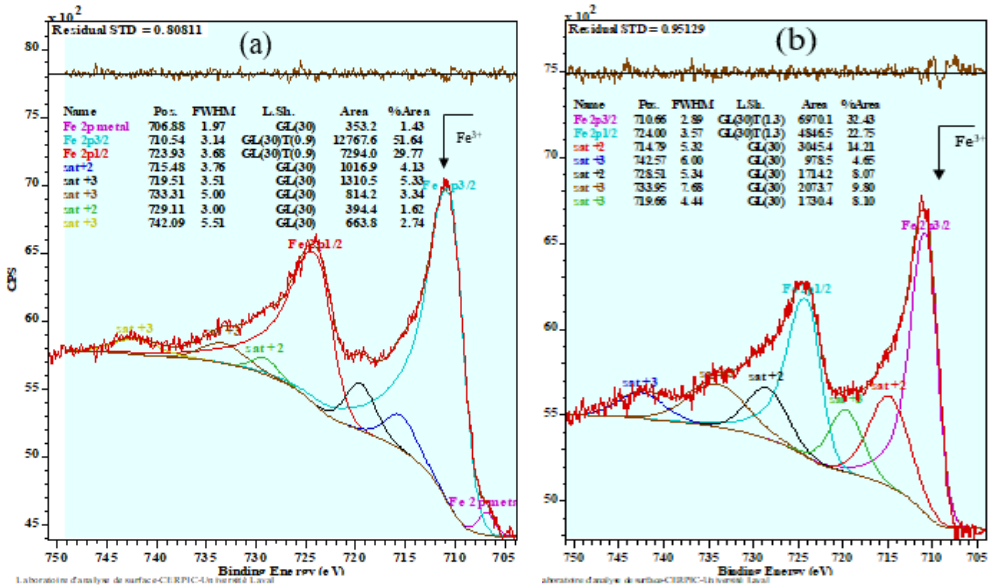
XPS Analysis

The XPS spectra shows a peak at 710.7 eV which can be associated with Fe^{+3} and appears on all the coatings (Figure S1). Satellite at 743.2 eV is characteristic of the Fe^{+3} state, and positions of satellites 2 and 3 in agreement with the Fe^{+3} state. Visually detectable Fe^{+2} satellites are seen as evidence of the mixture of Fe^{+3} and Fe^{+2}.



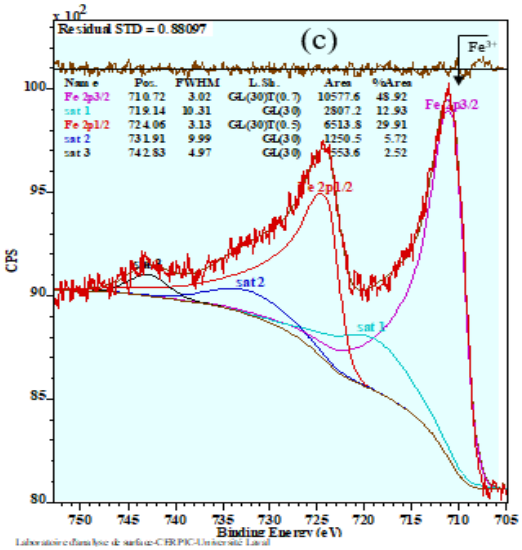


Figure S1. XPS spectra for Fe2p for: (**a**) Fe_3Al, (**b**) Fe_3Al/TiC, and (**c**) Fe_3Al-Cr/TiC.

The appearance of the peak at 74.7 eV in the sample before corrosion (Figure S2a) is assigned to the binding energy of Al^{3+} in Al_2O_3. This oxide could be formed during HVOF technique by the exposure of pure aluminum to air. In the case of the polarized (passivated) sample (Figure S2b), there is a shift in the Al^{3+} peak towards high binding energy. By deconvolution of the spectra, it was revealed the coexistence of Al^{3+} as Al_2O_3, $Al(OH)_3$ and $AlCl_3$ at 74.7, 75 and 77.29 eV, respectively. This result for Al is similar to what Frangini et al. [1] reported while comparing oxidized and passivated iron aluminide samples. They reported that the outer part of the passive film predominantly consists of mixed Al–Fe oxy-hydroxide, whereas the inner part is of mostly an Al-rich oxide phase.

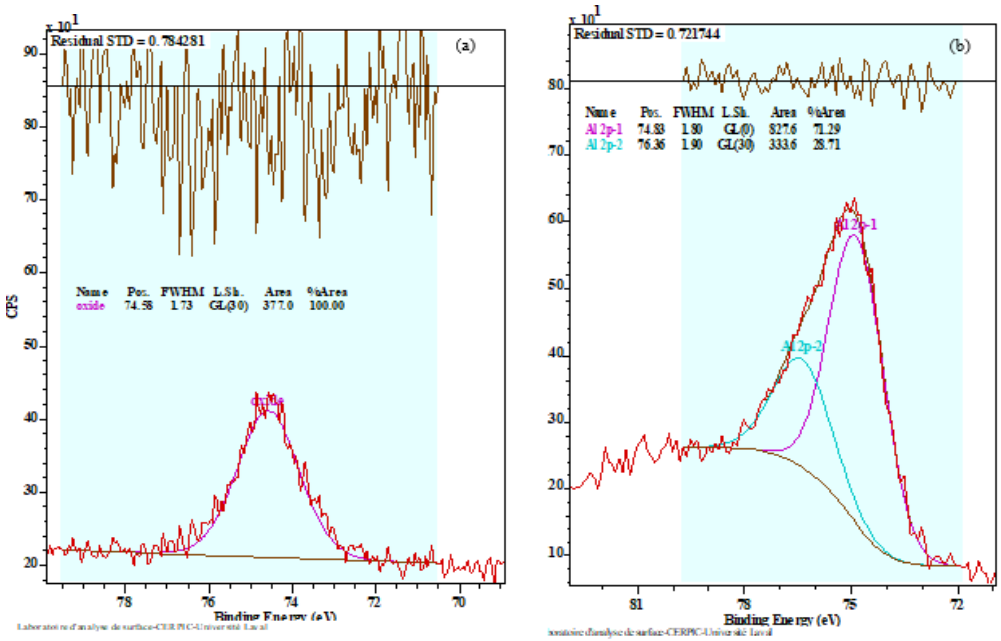


Figure S2. XPS spectra of Al2p for Fe_3Al/TiC: (**a**) before and (**b**) after polarization test.

On the passive layer of the two composites appears the peaks of Ti2p ($Ti2p_{1/2}$ and $Ti2p_{3/2}$) which are compatible to TiO and TiO_2. (Figure S3a,b). The peak of Cr2p appears on Fe_3Al-Cr/TiC and is attributed to $Cr(OH)_3$ that is formed in the passive layer (Figure S3c). These results indicate that the passive layer of the composite coatings (Fe_3Al/TiC and Fe_3Al-Cr/TiC) consists of a mixture of aluminum, iron and titanium oxide and aluminum hydroxide, and chromium hydroxide in the case

of Fe_3Al-Cr/TiC. The presence of hydroxide could be the result of hydration of a passive film that can happen by raising potential, as reported by Rao [2].

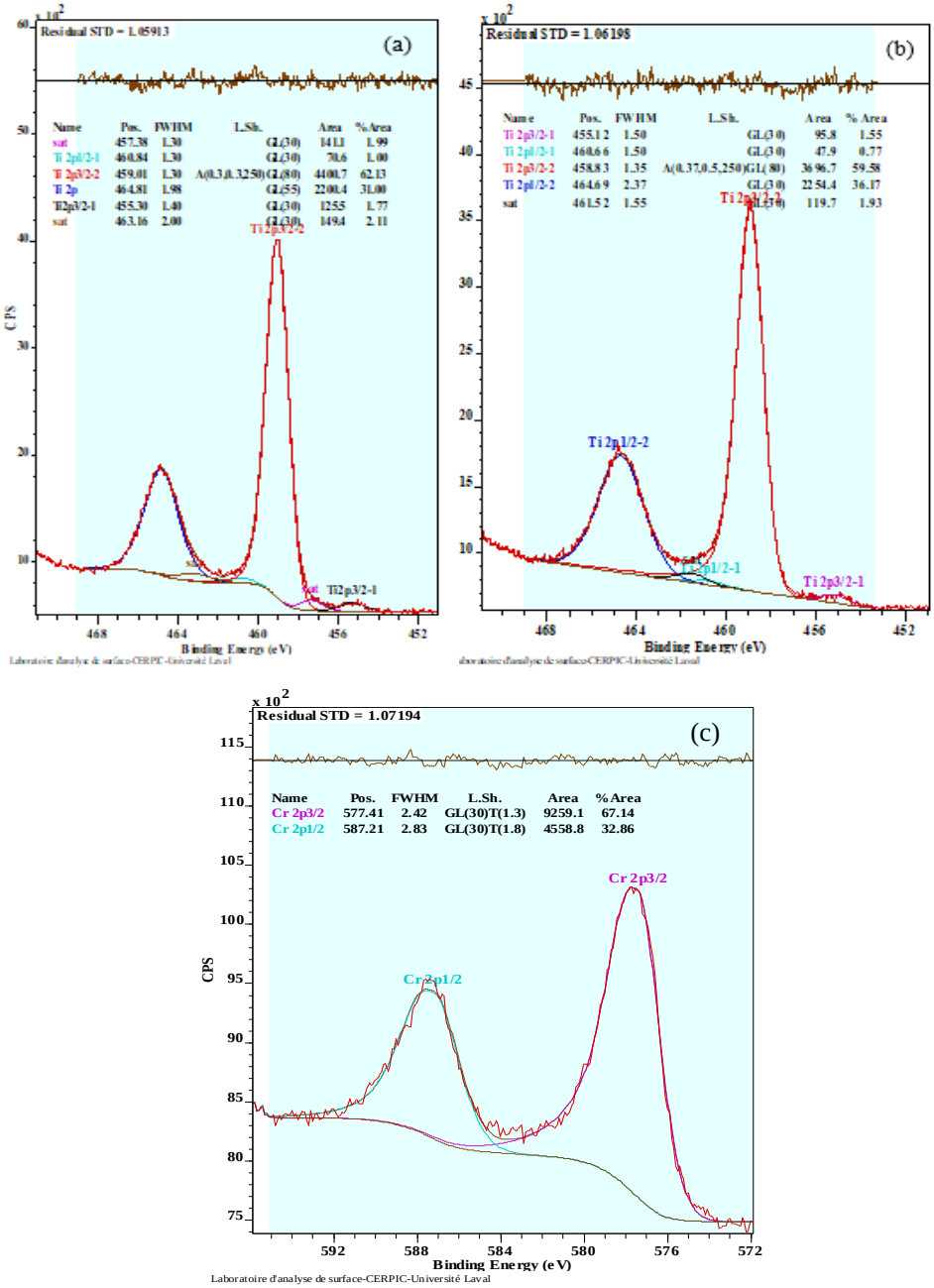


Figure S3. XPS spectra of Ti2p for: (**a**) Fe_3Al/TiC (**b**) Fe_3Al-Cr/TiC, and (**c**) Cr2p of Fe_3Al-Cr/TiC.

References

1. Frangini, S.; Masci, A. Intermetallic FeAl based coatings deposited by the electrospark technique: Corrosion behavior in molten (Li + K) carbonate. *Surf. Coat. Technol.* **2004**. *184*, 31–39.
2. Rao, V.S. Repassivation behaviour and surface analysis of Fe_3Al based iron aluminide in 0.25 M H_2SO_4. *Corros. Sci.* **2005**, *47*, 183–194.