***SUPLEMENTARY DATA***

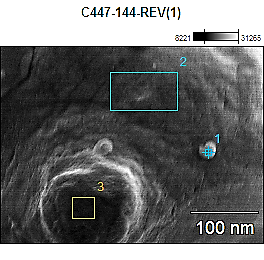
**Influence of cold gas spray parameters on the corrosion resistance of Al-Al2O3 coatings sprayed on carbon steel**

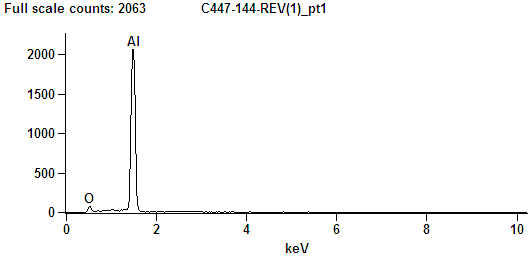
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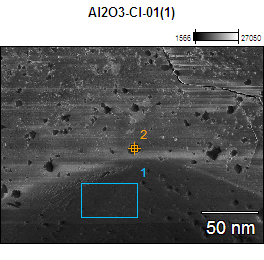


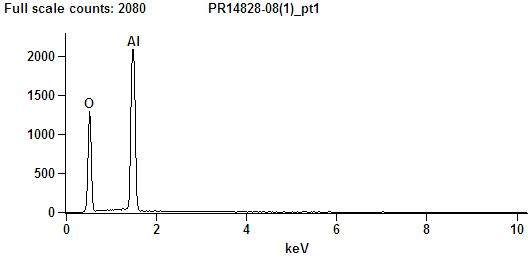


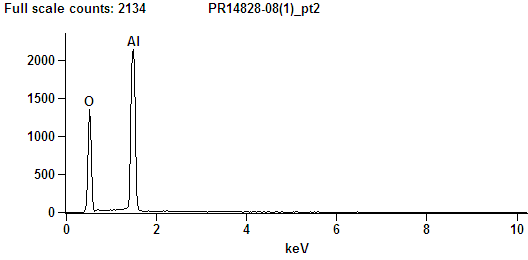
Weight %

|  |  |  |
| --- | --- | --- |
|  | ***O-K*** | ***Al-K*** |
| ***C447-144-REV(2)\_pt2*** | 2.06 | 97.94 |

(a)





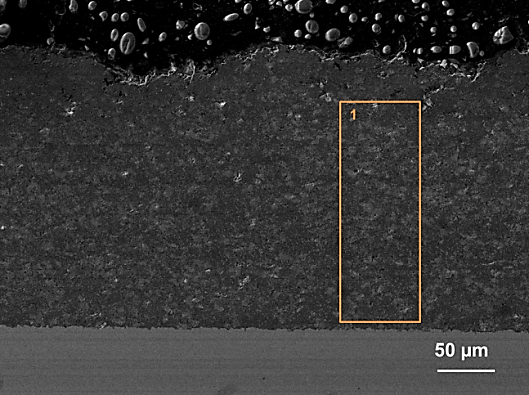
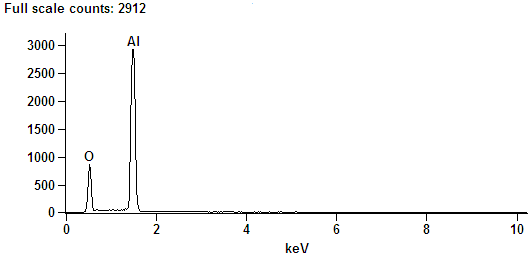


Weight %

|  |  |  |
| --- | --- | --- |
|  | ***O-K*** | ***Al-K*** |
| ***PR14828-08(1)\_pt1*** | 43.37 | 56.63 |
| ***PR14828-08(1)\_pt2*** | 43.82 | 56.18 |

(b)

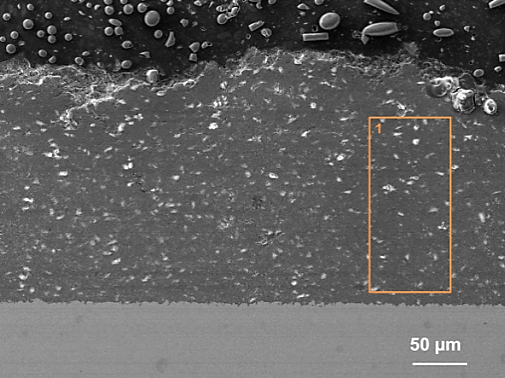
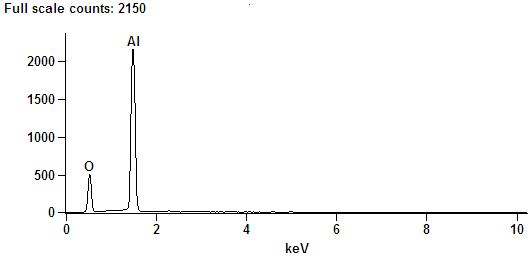
Fig. S1. EDS spectra of Al (a) and Al2O3 (b) powders, which revealed Al and oxygen.

Weight %

|  |  |  |
| --- | --- | --- |
|  | ***O-K*** | ***Al-K*** |
| ***PR14828-10(1)\_pt1*** | 28.16 | 71.84 |

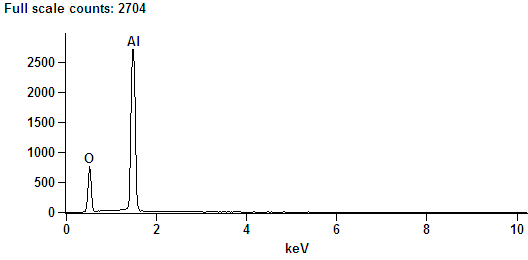
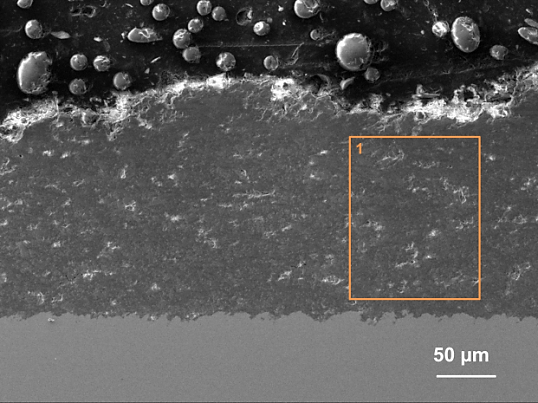
(a)

Weight %

|  |  |  |
| --- | --- | --- |
|  | ***O-K*** | ***Al-K*** |
| ***Al2O3--09(1)\_pt1*** | 28.57 | 71.43 |

(b)



Weight %

|  |  |  |
| --- | --- | --- |
|  | ***O-K*** | ***Al-K*** |
| ***Al-Al2O3-14(1)\_pt1*** | 30.20 | 69.80 |

(c)

Figure S2. EDS spectra of cross section for Al-Al2O3 coatings after ~1200 h of immersion in 3.5 wt.% NaCl solution: (a) 5T4, (b) 15T4 and (c) 15T3. The analysis revealed aluminum and oxygen. Iron was not detected all over the cross section even near the coating/substrate interface.



(a)



(b)

Fig.S3.(a) Nyquist diagrams, (b) Bode log |Z| *vs.* log f and Bode Φ *vs.* log f diagrams for the substrate in 3.5 wt.% NaCl solution, at 25 oC. The symbols correspond to the experimental data. The fittings are shown by the solid lines.



(a)



(b)

Fig.S4.(a) Nyquist diagrams, (b) Bode log |Z| *vs.* log f and Bode Φ *vs.* log f diagrams for the coatings after 200 h of immersion in 3.5 wt.% NaCl solution, at 25 oC. The symbols correspond to the experimental data. The fittings are shown by the solid lines.



(a)



(b)

Fig.S5.(a) Nyquist diagrams, (b) Bode log |Z| *vs.* log f and Bode Φ *vs.* log f diagrams for the coatings after ≈1300 h of immersion in 3.5 wt.% NaCl solution, at 25 oC. The symbols correspond to the experimental data. The fittings are shown by the solid lines.

Table S1. EEC parameters used to fit the EIS diagrams (Fig. 7S) obtained in 3.5 wt.% NaCl solution for the substrate and Al-Al2O3 coatings deposited on steel, and at different times of immersion. The values in parenthesis are the error percentage of each one of the EEC parameter.

**Steel Substrate**

|  |  |  |  |
| --- | --- | --- | --- |
| Time/h | 48 h | 96 h | 120 h |
| *R*s/Ω cm2 | 20 (0.2) | 20 (0.2) | 20 (0.2) |
| *1CPE*dl-T/µFcm−2 sndl−1 | 19 (13) | 47 (11) | 68 (4) |
| *n*dl | 0.83 (2) | 0.9 (2) | 0.94 (2) |
| *R*ct/kΩ cm2 | 0.9 (10) | 0.5 (4) | 0.3 (4) |
| *CPE*film-T/mF cm−2 snfilm−1 | 431 (1) | 833 (1.1) | 123 (0.2) |
| *n*film | 0.81 (1.2) | 0.77 (0.2) | 0.71 (0.1) |
| *R*film/kΩ cm2 | 1.4 (0.2) | 1.2 (0.2) | 1.1 (0.2) |
| χ2/10−5 | 0.4 | 0.5 | 0.1 |

**5T4**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Time/h | 24 | 200 | 450 | 550 | 700 | 1300 |
| *R*s/Ω cm2 | 17 (0.4) | 19 (0.1) | 16 (0.3) | 16 (0.3) | 16 (0.5) | 19 (0.5) |
| *CPE*dl-T/µF cm−2 s*n*dl−1 | 82 (0.5) | 82 (0.4) | 85 (0.4) | 105 (0.7) | 120 (1) | 125 (1) |
| *n*dl | 0.8 (0.1) | 0.76 (0.1) | 0.76 (0.1) | 0.72 (0.1) | 0.71 (0.1) | 0.71 (0.1) |
| *R*ct/kΩ cm2 | 1.7 (0.7) | 2.7 (0.7) | 4.0 (1) | 5.6 (1) | 4.3 (1.2) | 5.3 (1.2) |
| *CPE*po-T/mF cm−2 s*n*po−1 | 2.4 (3) | 3.1 (3) | 1.5 (8) | 4.2 (11) | 4.66 (10) | 7.7 (10) |
| *n*po | 0.55 (2) | 0.7 (1.6) | 0.62 (4) | 0.84 (5) | 0.85 (5.7) | 0.97 (5.7) |
| *R*po/kΩ cm2 | 2.6 (4) | 2.2 (4) | 4.8 (7) | 3.5 (9) | 3.0 (9) | 2.6 (9) |
| χ2/10−4 | 1.5 | 1.0 | 5.0 | 7.0 | 1.1 | 1.3 |

**15T4**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Time/h | 96 | 170 | 378 | 520 | 810 | 1000 | 1300 |
| *R*s/Ω cm2 | 20 (0.2) | 20 (0.2) | 21 (0.2) | 20 (0.2) | 20 (0.3) | 19 (0.5) | 17 (0.5) |
| *CPE*dl-T/µF cm−2 s*n*dl−1 | 82 (0.7) | 86 (0.6) | 89 (0.5) | 92 (0.5) | 103 (0.6) | 102 (0.6) | 95 (1) |
| *n*dl | 0.76 (0.1) | 0.75 (0.1) | 0.74 (0.1) | 0.73 (0.1) | 0.71 (0.2) | 0.71 (0.2) | 0.71 (0.2) |
| *R*ct/kΩ cm2 | 2.4 (1) | 3.1 (1) | 4.3 (0.8) | 5.7 (0.8) | 7.1 (1.3) | 6.5 (1) | 8.5 (3) |
| *CPE*po-T/mF cm−2 s*n*po−1 | 1.8 (4) | 1.4 (4.5) | 1.6 (4.7) | 2.5 (8.5) | 2.6 (13) | 2.3 (12) | 1.2 (11) |
| *n*po | 0.55 (3) | 0.57 (3.3) | 0.68 (2.5) | 0.8 (3.6) | 0.78 (5.7) | 0.77 (5) | 0.62 (12) |
| *R*po/kΩ cm2 | 4.3 (6) | 5.7 (6.7) | 5.6 (4.2) | 4.4 (5.8) | 5.3 (10) | 5.1 (8) | 10 (13) |
| χ2/10−4 | 0.2 | 0.2 | 0.2 | 0.2 | 4 | 4 | 1 |

**15T3**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Time/h | 24 | 120 | 200 | 400 | 720 | 1200 |
| *R*s/Ω cm2 | 29 (0.1) | 36 (0.2) | 33 (0.4) | 28 (0.4) | 30 (0.5) | 30 (0.3) |
| *CPE*dl-T/µF cm−2 s*n*dl−1 | 19 (0.5) | 25 (0.5) | 27 (0.7) | 29 (0.8) | 19 (3) | 20 (2.4) |
| *n*dl | 0.8 (0.1) | 0.8 (0.1) | 0.8 (0.1) | 0.8 (0.1) | 0.85 (0.5) | 0.84 (5) |
| *R*ct/kΩ cm2 | 9.2 (1) | 14 (0.6) | 15 (0.7) | 12.3 (15) | 2 (15) | 1.6 (5.2) |
| *CPE*po-T/mF cm−2 s*n*po−1 | 0.4 (3.4) | 0.7 (4.5) | 1.3 (8) | 1.2 (3) | 24 (3) | 35 (2) |
| *n*po | 0.52 (2.8) | 0.8 (2) | 0.92 (2) | 0.82 (4) | 0.64 (1.3) | 0.72 (1.3) |
| *R*po/kΩ cm2 | 21 (6) | 20.5 (4.6) | 14.5 (5.4) | 13 (8) | 12.5 (4) | 8.1 (1.6) |
| χ2/10−4 | 1.8 | 3.3 | 7.8 | 9.6 | 5 | 3 |