dlyte

THE NEW CONCEPT OF POLISHING

Corrosion tests

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VISUAL EVALUATION RESULTS.

Shinnier aspect than parts treated with traditional electropolishing

CORROSION TESTS RESULTS.

The electrochemical behaviour of samples has been studied in a highly corrosive solution ([NaCl]= 30 g/L).

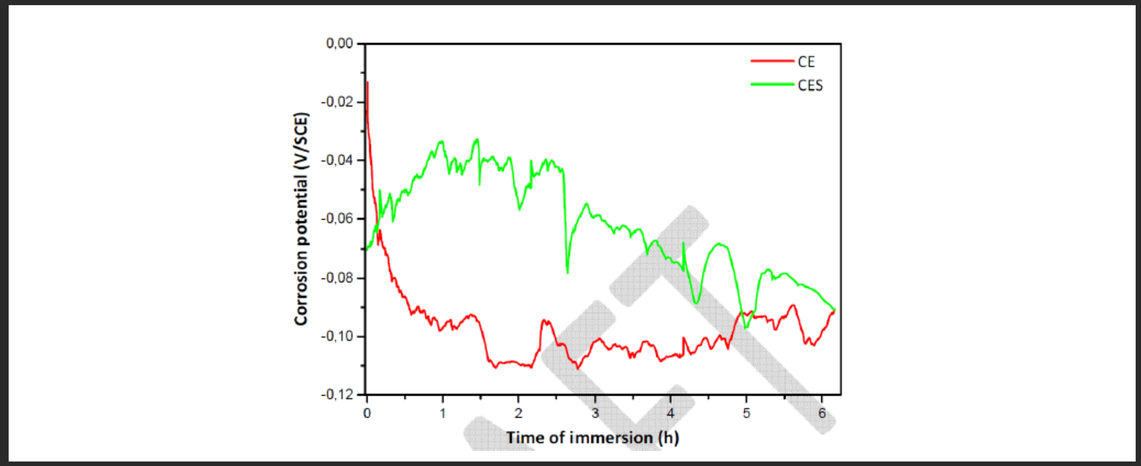
Measure of open circuit potential after 0 2 4 and 6 hours of immersion.

Measure of polarization resistance after 0 2 and 4 hours of immersion.

Measure of anodic polarization after 6 hours of immersion.

CORROSION TEST RESULTS.

CORROSION POTENTIAL VS IMMERSION TIME



The traditionnaly EP sample becomes less noble over time (red curve)

The dry EP sample becomes more noble until 2 hours of immersion and then decreases progressively (green curve)

After 6 hours, the dry EP sample and the EP sample have the same corrosion potential (Ecorr)

The dry EP sample has a better protection to corrosion until 6 hours of immersion (green curve above the red curve)

CORROSION TEST RESULTS.

POLARISATION RESISTANCE VS IMMERSION TIME

Immersion time	0h	2h	4h
CE	0,45 kΩ	2,83 kΩ	0,91 kΩ
CES	7,87 kΩ	12,40 kΩ	14,34 kΩ

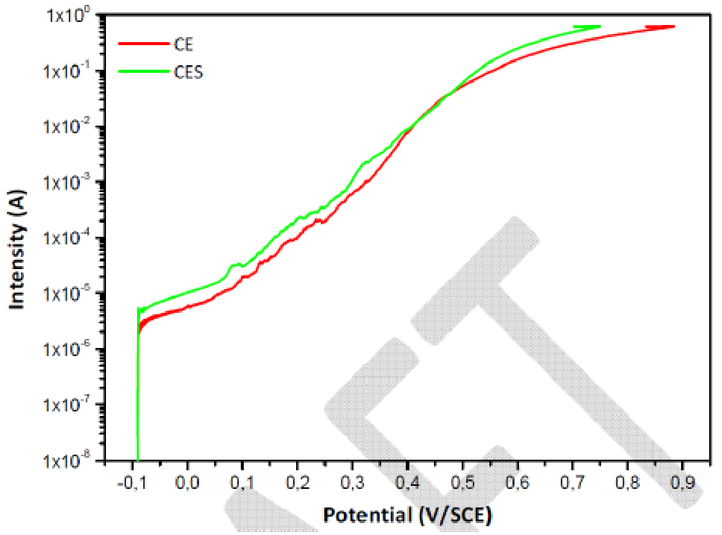
Table 2: Values of polarisation resistance depending on immersion time

Up to 4h of immersion, the dry EP sample has a higher polarisation resistance (Rp).

As Rp is inversely proportionnal to the corrosion rate, the dry EP sample corrodes between 4 to 15 times slower than the tradionally EP sample

CORROSION TEST RESULTS.

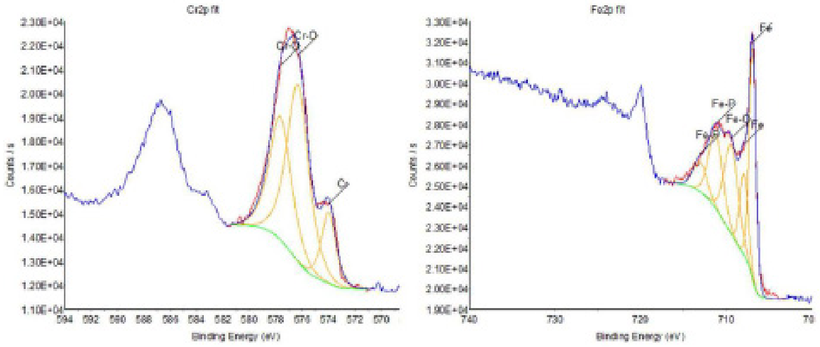
ANODIC POLARISATION AFTER 6 HOURS OF IMMERSION



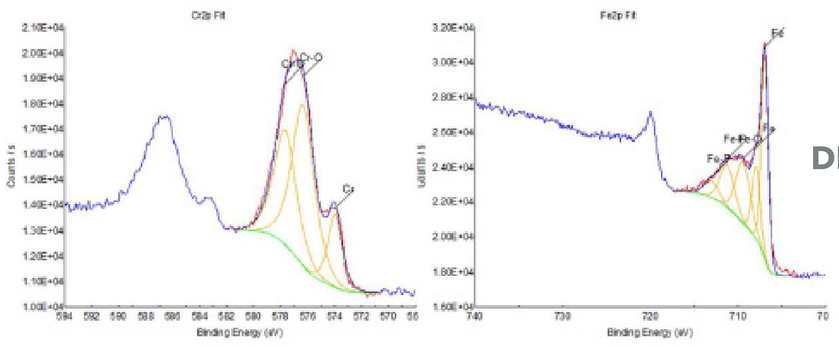
The two samples show the same behaviour after 6 hours of immersion.

XPS ANALYSIS RESULTS.

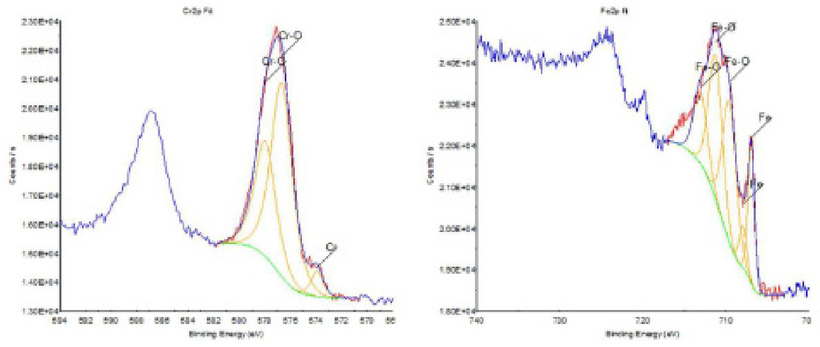
SURFACE CHEMICAL COMPOSITION



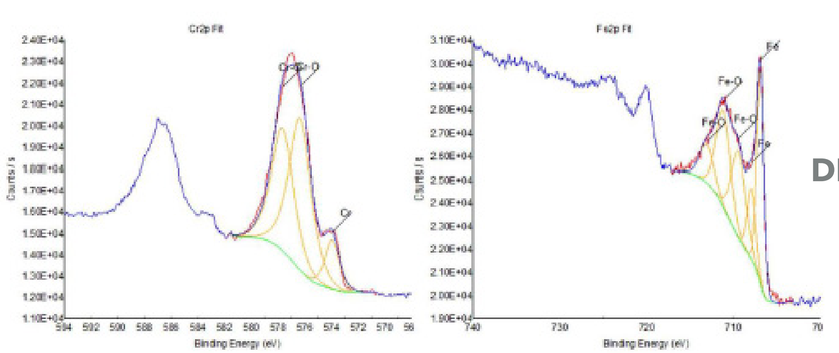
EP (external)



DRY EP (external)



EP (internal)



DRY EP (internal)

XPS ANALYSIS RESULTS.

SURFACE CHEMICAL COMPOSITION

Peak fit carried out according to SEMASPEC #90120403B-STD procedure

	Cr(ox)/Fe(ox)
EP (external)	1.4
EP (internal)	1.3
DRY EP (external)	1.7
DRY EP (internal)	1.5

The oxide component ratio Cr(ox)/Fe(ox) is similar on the EP and DRY EP samples.

The dry EP sample has been succesfully electropolished on the external and internal surfaces.

XPS ANALYSIS RESULTS.

OXIDE THICKNESS DETERMINATION

	Oxide thickness (nm)	
	Chromium oxide	Iron oxide
EP (external)	5.0	2.0
EP (internal)	7.1	3.6
DRY EP (external)	4.8	1.7
DRY EP (internal)	5.5	2.3

The dry EP sample has been succesfully electropolished on the internal and external surfaces.

The chromium oxide thickness is superior to the iron oxide thickness.

CONCLUSIONS.

The parts treated by dry EP are shinier.

Dry EP affects the external and internal surfaces (no need for internal electrodes): verified by oxide thickness and oxide ratio measurements.

Dry EP gives a better resistance to corrosion up to a certain duration, after which the sample shows the same behaviour than a traditionally EP sample.

Technically, the dry EP process of GPA Innova could be a good alternative to the traditional EP.