Efficient Evaluation of Amorphic Corrosion Resistance using Linear Polarization Resistance (LPR)

For our customer Bunge Amorphic Solutions, VLCI has evaluated their Amorphic anti-corrosive pigment via various electrochemical methods, using a potentiostat (Electrochemical Impedance Spectroscopy (EIS), Linear Polarization Resistance (LPR)). Amorphic has shown excellent performance against a commercial competitor.

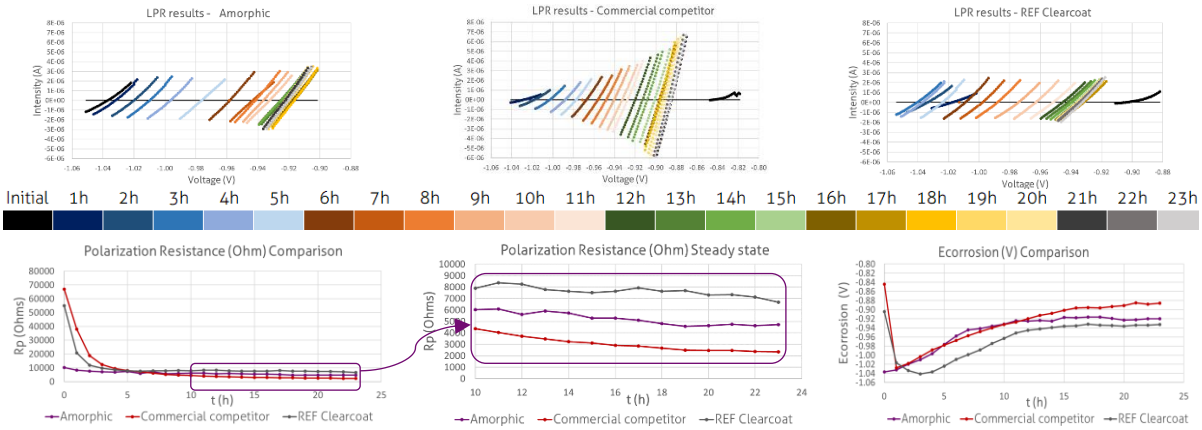
About Linear Polarization Resistance

LPR is a quick and non-destructive electrochemical method, providing useful and reliable corrosion rate date. In this method, the potential is swept in a small range around the open-circuit potential, and the resulting current of the tested system is measured. The polarization resistance is represented by the slope of applied potential and the resulting current, following the Ohm's law. The method provides two significant parameters over testing time, which cannot be obtained with standard EIS method:

- $E_{corrosion}$, as the voltage generated by the corrosion process.
- Polarization resistance, relating corrosion intensity and corrosion rate.

Evaluating the performance of Amorphic in protective coatings

VLCI has screened the performance of Amorphic in a water-based acrylic resin suitable for protective applications, and compared with a commercial competitor. A clear-coat without anti-corrosive pigment was used as a reference. The graphs below display LPR results, as well as the comparison in polarization resistance and $E_{corrosion}$ for each system.



As seen in the graphs above, when reaching the steady state, Amorphic is performing better than the commercial competitor. The reference clear-coat shows a higher polarization resistance, which can be explained by its lower porosity. The results in $E_{corrosion}$ show a virtually identical evolution of the clear-coat and the Amorphic-based coating. The values with the commercial competitor are slightly higher, indicating that a part of the pigment has dissolved in the electrolyte, losing on corrosion inhibition. These results are correlating with the EIS testing which was performed in parallel (see TDC doc: Efficient Evaluation of Amorphic Corrosion Resistance using Electrochemical Impedance Spectroscopy (EIS)).

What are the targeted product developments?

The targeted applications are protective coatings, from high to low PVC levels. VLCI can help you implementing Amorphic in your formulation, to achieve the desired properties, and quickly and efficiently assess the corrosion inhibition using these electrochemical methods.

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