

Test your coating’s performance using EIS

13 April 2026, 09:15

Jérika Lamas

Electrochemical testing helps you get a grip on coating performance and behaviour assessment

The importance of coating performance and durability in optimizing metal products’ lifecycle can hardly be overrated. But in tough and remote environments, it is far from easy to assess this performance. Electrochemical testing methods such as EIS, however, help you obtain a reliable assessment.

Coatings are among the most effective and widely used methods to protect metals from corrosion. They provide a physical and often chemical barrier between the metal surface and the surrounding environment. Thus they help prevent direct exposure to moisture, oxygen, salts, and other corrosive agents.

Protective coatings play a vital role across industries such as oil and gas, offshore, marine, infrastructure, automotive, and energy. In these sectors, they safeguard metal structures and components from corrosion, extending their operational lifetime in harsh environments.

In modern corrosion management, coatings are often combined with cathodic protection or smart monitoring technologies. This creates a multi-layered defence strategy that enhances asset durability and reliability. However, maintaining coating performance over time requires continuous evaluation. This becomes even more challenging for remote installations or when selecting the most suitable coating for a specific environment.

EIS: a powerful, non-destructive assessment technique

This is where electrochemical testing plays a crucial role. Electrochemical Impedance Spectroscopy (EIS) is a powerful, non-destructive technique used to assess coating performance and durability. It measures how a coated metal resists electrochemical reactions over time.

By analysing impedance spectra, it is possible to detect differences in coating quality, barrier properties, and degradation behaviour under specific conditions such as saltwater exposure, humidity, or temperature fluctuations.

Figure 1 shows such an assessment over a longer period. The coated metal were evaluated under constant exposure conditions and monitored over time. The Zmod value (solid line) is an indicator of the corrosion process at the metal interface. The decrease over time in Zmod at low frequencies points to pores and defects in the coating, causing active corrosion on the metal substrate.

The phase angle Zphz (dashed line) reflects the capacitive behaviour of the coating. Phase angles closer to ?90° are associated with an intact coating with low permeability, behaving as an effective barrier. Over time, the phase angle spectrum evolves from an almost ideal capacitive response (highest dotted line) toward a more pronounced S-shaped curve, with a decrease in phase angle at mid frequencies . This shift indicates a significant coating degradation and loss of barrier properties even after 22 days.

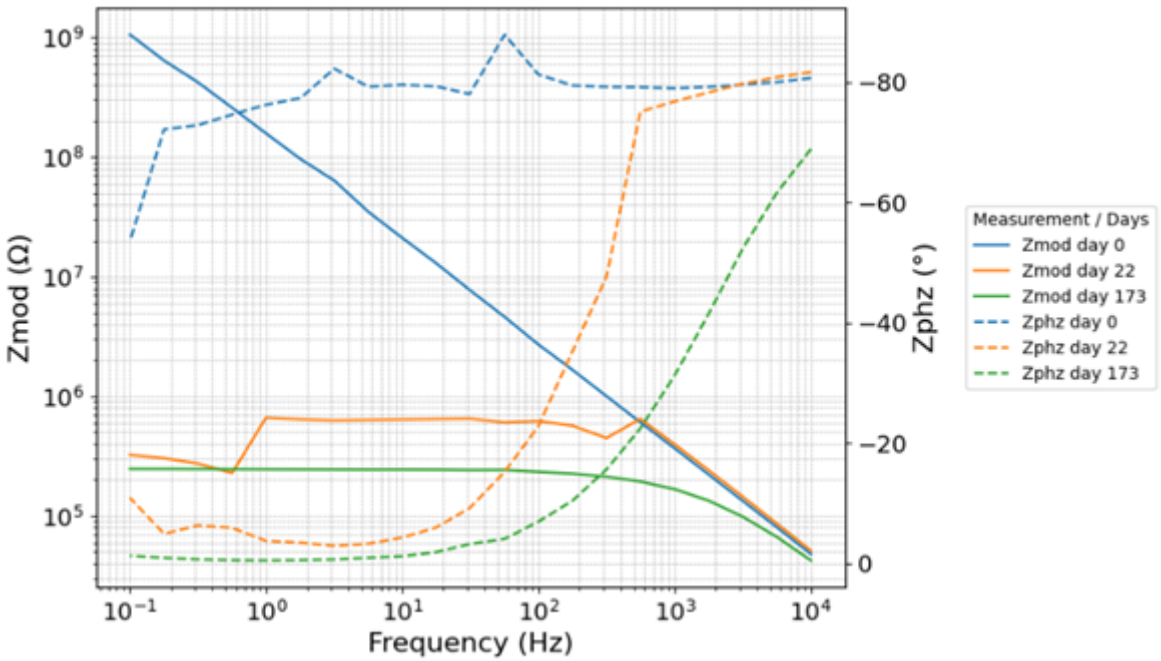


Figure 1: example EIS Bode plot illustrating coating degradation over time

Various uses of EIS

These EIS measurements and resulting graphs help industries in various ways. They can detect failure under different climatic conditions early on. They can apply different coatings in similar conditions and perform comparative evaluations in an early stage. They will get some valuable quantitative insights into the coating barrier performance. And they will better be able to estimate the coating lifetime and therefore to predict when maintenance is required.

EIS testing can be applied in laboratory studies, field monitoring, or accelerated aging tests under realistic industrial conditions.

Download the presentation on electrochemical coating assessment

Want to better understand how Electrochemical Impedance Spectroscopy (EIS) helps assess coating performance, degradation behaviour and corrosion resistance? Download the presentation and discover how electrochemical testing supports reliable coating evaluation under harsh environmental conditions, helps compare coating systems and provides insights into long-term durability and maintenance needs.

Download the presentation

Wondering which EIS application suits your needs?

At Sirris, we help customers assess coating performance at all stages: from laboratory scale, relevant industrial environment and field monitoring, allowing fine-tuning of coating types before they are applied in operational environments. Additionally, we support in-field coating monitoring in collaboration with industrial partners to ensure long-term protection and reliability.

For more information about EIS testing for your specific application, contact us to see how we can tailor the right test for your needs.

Contact us

Authors



Jérika Lamas