Encapsulated Inhibitive Pigment for Smart Anti-corrosive Epoxy Coatings

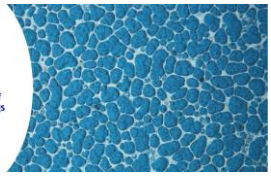
Lamprakou, Zoi; Bi, Huichao (Teresa); Weinell, Claus Erik; Tortajada, Silvia; Dam-Johansen, Kim

Publication date:
2022

Document Version
Peer reviewed version

Citation (APA):
Lamprakou, Z., Bi, H., Weinell, C. E., Tortajada, S., & Dam-Johansen, K. (2022). *Encapsulated Inhibitive Pigment for Smart Anti-corrosive Epoxy Coatings*. Abstract from 12th International Workshop on Application of Electrochemical Techniques to Organic Coatings, Cavalese, Italy.

AETOC 2022
12th International Workshop on Application of Electrochemical Techniques to Organic Coatings
29th March - 1st April 2022
Val di Fiemme, Trentino - Italy



Encapsulated Inhibitive Pigment for Smart Anti-corrosive Epoxy Coatings

Zoi Lamprakou, Huichao Bi, Claus Erik Weinell, Silvia Tortajada, Kim Dam-Johansen*

CoaST, Department of Chemical and Biochemical Engineering, Technical University of Denmark (DTU), Building 229, 2800 Kgs. Lyngby, Denmark

*Referring author: hubi@kt.dtu.dk

Keywords: *Smart coatings, Inhibitive pigment, Corrosion, Encapsulation, EIS.*

Applying organic coatings is the most common way to protect metal structures from corrosion failures. An anti-corrosive coating offers an effective physical barrier, impeding the diffusion of corrosive species to the metal substrate. To enhance the coatings' anti-corrosive properties, the addition of pigments that inhibit the corrosion process is required if the barrier effect is disrupted.

In a conventional coating, the water uptake and the prolonged exposure to wet conditions can wash away part of the inhibitive pigment. This spontaneous release regardless of whether or not corrosion is likely to occur, can lead to a fast depletion of the coating from the inhibitive pigment and also sacrifice the barrier properties of the coating film. Thus, a higher pigment concentration is needed for sufficient long-term protection. Smart coatings with encapsulated inhibitive pigment, on the other hand, are able to respond to external triggering like changes in the pH and release the inhibitive species from the functional nanoparticles. The controlled release of the inhibitive ions prevents spontaneous material losses and enhances the durability of the coatings.

In the present work, calcium phosphate was encapsulated into mesoporous silica nanoparticles (MSN). The effect of pH on the structure and morphology of the MSN and the release of calcium phosphate from the MSN was investigated. Epoxy coatings with encapsulated (3 wt.%) and non-encapsulated (3 wt.% and 5 wt.%) calcium phosphate were formulated and their anti-corrosive performance was evaluated by Open Circuit Potential (OCP) and Electrochemical Impedance Spectroscopy (EIS) techniques. Results showed that encapsulation of the calcium phosphate as inhibitive pigment in the epoxy coating can enhance the anti-corrosive performance by preventing spontaneous pigment dissolution and controlling the pigment's release from the coating.