Sensing active coating on the basis of nanoreactors containing pH indicating agent

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The main idea of this work is to create a novel functionality on active coatings able to sense the initiation of corrosion under the coating or in defects. The goal is to significantly reduce the maintenance costs in many industrial applications. The indication of corrosion activity by such coatings allows optimizing the maintenance operations, avoiding excessive and unnecessary preventive operations.

The present development involves a new sensing active coating on the basis of nanoreactors containing a pH indicating agent (Fig. 1). An important feature of these nanostructures is that the indicating molecules are not released from them, thereby preventing the spontaneous leaching and ensuring long service time.

Mesoporous silica nanocontainers were synthesized and loaded with phenolphthalein (pH indicator) in a one-stage process. The resulting system was mesoporous, which together with the bulkiness of the indicator molecules limits their leaching (Fig. 2). Moreover, the penetration of water molecules and ions inside the mesopores is possible, allowing the hydroxide ions formed on cathodic areas to react with the pH indicator. Colour change is used to detect and locate the active corrosion spots in the coated system. The corrosion sensing functionality of the protective coatings with nanocontainers was proven for aluminium and magnesium based metallic substrates. The developed nanocontainers show high potential to be used in the new generation of active high performance multifunctional protective coatings.

REFERENCES

F. Maia, J. Tedim, A.C. Bastos, M.G.S. Ferreira, M.L. Zheludkevich, Nanocontainer-based corrosion sensing coating, *Nanotechnology*, 24 (2013) 415502. http://dx.doi.org/10.1088/0957-4484/24/41/415502

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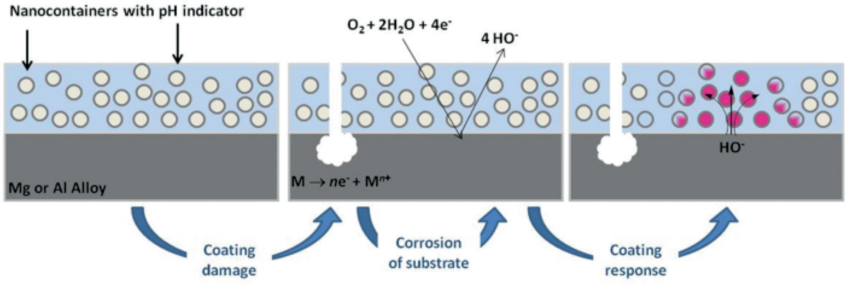
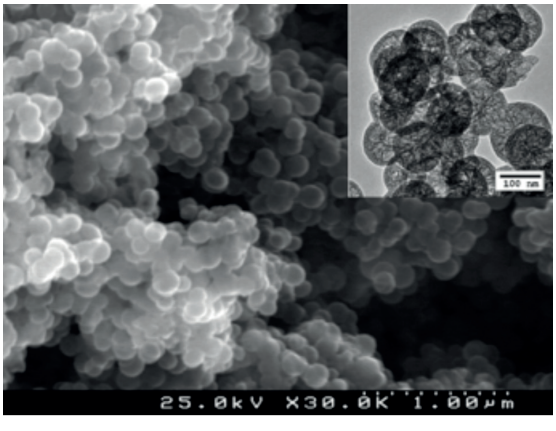


FIGURE 1
Scheme of pH sensing response from coating.



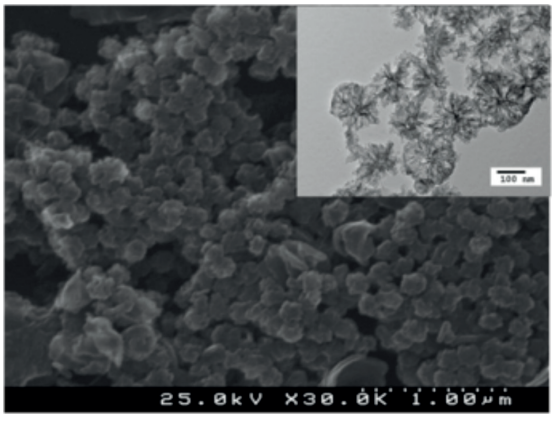


FIGURE 2
SEM images of Si_NC: (left) empty (inset: TEM picture of Si_NC with scale bar of 100 nm) and (right) with PhPh (inset: TEM picture of Si_NC-PhPh with scale bar of 100 nm).