Development of Inhibitor Containing Smart Corrosion Protective Coatings

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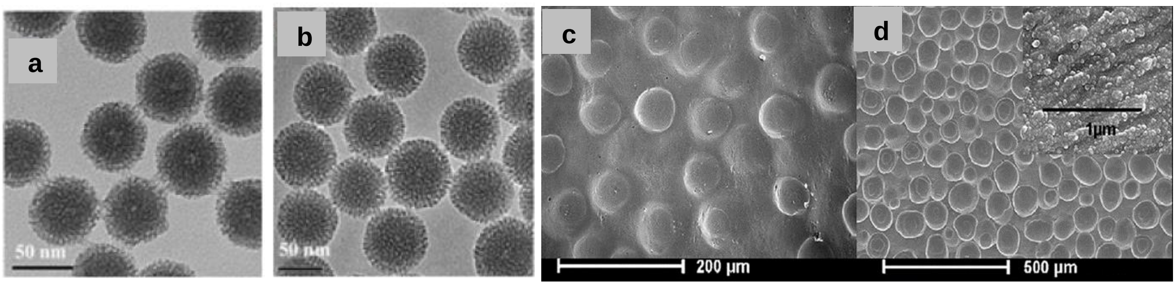
The cost of corrosion is reported to be more than 3% of Gross Domestic Product (GDP) in recent years, leading to urgent demand on reliable corrosion protection technologies. Currently, corrosion protective coatings based on Zinc metal containing paint and hot dip galvanized Zinc coating are widely used in industry due to the cost-effective and high reliability properties[1,2]. However, these coatings have drawbacks of insufficient long durability or with environmental issues, or cannot be applied on-site, which is required by some applications, such as construction industry, where long term overall protection is needed. Development of more effective corrosion inhibitors is one promising solution to provide better protection even under harsh conditions. However, adding corrosion inhibitors directly to the coatings is not a reliable solution as they will be consumed in a short period losing its long term protection[3,4]. One more gap in current market is the failure of protection in case of mechanical damages such as scratching, which cannot be prevented in realistic situation. These damages lead to the failure of corrosion protection ability, high cost maintenance, and lower productivity. Aiming to solve aforementioned problems, this work is focused on the development of three different types of corrosion inhibitor containing functional materials, and tests on the corrosion resistance of them. Corrosion inhibitors can be entrapped into the structure of functional carrier, thus being locked in the chemical bond. The loaded inhibitor can be released by two main corrosion “stimulators”: moisture and chloride. The corrosion inhibitors or sealing agent can also be encapsulated by polymer or silica shell, which will be broken by mechanical damage thus heal the scratch. Highly porous particles loaded with corrosion inhibitors are able to release the inhibitors with controlled rate, extending the protection duration. The encapsulated inhibitors are loaded into sol-gel based anti-corrosion coating and the mechanical and corrosion protection performance are evaluated by Scientific Instruments and corresponding international standards. The synergistic effects of these three types of corrosion inhibitor containing functional materials are also analysed using statistical modelling methodologies.



Synthesized mesoporous silica particles (surface area: 1000 m^2/gPore size: 2.5 nm), loaded with inhibitors, and added into sol-gel coatings.

References:

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