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Functional and smart coatings for corrosion protection: a review of recent advances

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Abstract

Coatings tailored to corrosion protection of metallic substrates are of the utmost relevance to ensure reliability and long-term performance of coated parts as well as the product value of the coated materials. Presently, there is a strong emphasis on the development of advanced functional and smart coatings for corrosion protection in different technological applications. On the one hand, there is a need for more advanced coatings for conventional applications and, on the other hand, there is a need to answer the requirements of several new Hi-Tech applications. Thus, this review highlights the most recent trends in the field of functional coatings for corrosion protection of metallic materials in a wide range of technical applications. Emphasis is given to self-healing coatings and smart coatings combining multiple functionalities for increased corrosion protection. Recent developments on the introduction of functionalities based on encapsulation of corrosion inhibitors, anti-fouling agents and superhydrophobic additives or modification of organic and hybrid matrices *via* chemical manipulation are reviewed. Special attention is dedicated to functional coatings for corrosion protection of bioresorbable metallic implants that have an important impact in biomedical applications.

Keywords: functional coatings, corrosion protection, self-healing, smart coatings, biocompatible coatings

List of abbreviations:

EIS – Electrochemical Impedance Spectroscopy

LEIS – Localised Electrochemical Impedance Spectroscopy

SVET – Scanning Vibrating Electrode Technique

SIET – Selective Ion Electrode Technique

NMR - Nuclear Magnetic Resonance

SIET - Selective Electrode Technique

SEM - Scanning Electron Microscopy

FIB - Focused Ion Beam

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