Chapter 5
Functional and Intelligent Coatings to Prevent Corrosion:
An Overview of Current Developments

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ABSTRACT

The intrinsic features and chemistry of smart coatings on modification have led to their recognition in the fields of material sciences, colloidal chemistry, biomedical sciences, and polymer chemistry. Smart coatings have proven to have better qualities than standard coatings, thanks to the utilization of formulas ranging from micro- to nanoparticles and mixtures of organic and inorganic phases. The superior effectiveness of smart inhibitory materials over micro- and macro-particles has been further boosted by the usage of materials at the nano scale. Metal and metal oxide nanoparticles, which offer a variety of functional qualities and improved performance, are included in many smart coatings. The multifunctional coatings are anticipated to be produced by their hybrid nanoparticles. Nanoparticles' special qualities—such as their large surface area, surface activity, relaxation of magnetic resonance, electronic sensitivity, etc.—depend on their size and shape. Smart coatings are special because of their remarkable inventions and ongoing rapid development.

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1. INTRODUCTION

Baghdachi, J. et.al stated that the reducing the usage of expensive petroleum-based solvents and lowering volatile organic content (VOC) have had a significant impact on coatings technology during the past 25 years. Powdered, water-soluble, UV-curable, and the use of solids coatings has expanded significantly. Historically, the main purposes of these coatings were to decorate and preserve substrates (Baghdachi et al., 2009). Tejero-Martin, et .al in his study presents a thorough overview of the status of functional and intelligent coatings made by thermal spray deposition. Initially, it will outline the various thermal spraying technologies, emphasizing how various methods get the thermal and kinetic energy needed to produce a coating. Additionally, it will concentrate on the temperature and velocity environment that feedstock particles are subjected to (Tejero-Martin et al., 2019). Ulaetoet.al told that modern functional and intelligent coatings applied by thermal spraying techniques will be covered first; then, the principles of coating design and performance efficiency will be discussed; finally, successful current and future applications will be detailed (Ulaeto et al., 2019).

Zahidah et.al showed that, the coating efficiency is insufficient for applications in harsh and hostile settings. Metal protection is improved when corrosion inhibitors are added or incorporated with protective coatings. The development of halloysite nanotubes as a nano container for smart coating applications is reviewed in this article (Zahidah et al., 2017). Wang, et.al explained the process of self-healing AVC functionalized by microcapsule insertion is more understood thanks to this work (Wang et al., 2014). Nazeer et.al Since release the coat's active ingredients in a controlled way to stop fractures from spreading across the protective layer, smart self-healing coatings have demonstrated potential corrosion protection of metals and alloys in a variety of technological applications (Nazeer et al., 2018). Zheludkevich .et.al explained the most popular and economical way to prevent corrosion and prolong the service life of many metallic structures in corrosive conditions is to apply organic coatings. On the other hand, as soon as the barrier of protection is broken, the deterioration processes start moving quickly. To provide a long-term impact, an active protection strategy based on coating flaws' "self-healing" is therefore required (Zheludkevich et al., 2012). Lv, W., et.al created smart coatings, the polymer film, pigment, and manufacturing technology should all be taken into account. Among them, the creation and synthesis of stimuli-responsive polymeric films is crucial because it affects the formation and surface characteristics of films and displays "switchable" and desired features based on external settings (Lv et al., 2008). Tejero-Martin et.al. studied the intrinsic qualities of the materials that are chosen for use in industrial applications must meet the requirements of the component that is being developed and produced. Structural components are a prime example, as