

Chapter 5

Materials Used to Protect Metals Against Corrosion in the Electric Car Industry

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ABSTRACT

In the electric car industry, corrosion poses a significant threat to metal components, leading to material degradation, loss of structural integrity, and reduced perfor-

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mance. Corrosion occurs through chemical, electrochemical, and physical reactions, affecting metals like iron, platinum, and others. Various forms of corrosion—such as uniform, galvanic, and pitting corrosion—can occur depending on environmental conditions. To mitigate corrosion in electric vehicles, protective materials are used, including coatings, anodic and cathodic protection, and environmental controls. These methods help preserve metal strength, extend the lifespan of components, and maintain the overall efficiency and safety of electric vehicles. Understanding corrosion mechanisms is essential for implementing effective prevention strategies in the rapidly growing electric vehicle sector.

INTRODUCTION

Corrosion is the permanent degradation of materials and surfaces due to chemical, electrochemical, or physical interactions. These reactions can lead to the loss of structural integrity in metals, resulting in significant damage. Corrosion is widely recognized as a major cause of material deterioration, prompting extensive research into materials protection methods (Harsimran et al., 2021; Xia et al., 2022).

A substance is deemed to be corrosion-resistant or has a reduced susceptibility to corrode. Corrosion can start through a range of potential mechanisms, and no metal group is entirely immune. Even noble and valuable metals undergo considerable reactions with the environment, as seen with platinum. The interactions between metals and elements in their environment can be demonstrated by the reactions involving iron and other metals (T.-H. Yang et al., 2021; Zhang et al., 2021). Thermodynamically, the chemical reaction of iron with oxygen to create iron oxides consistently leads to chemical reactions in these forms.

Corrosion can manifest in various ways, ranging from abrupt to gradual, localized to widespread, and from mild, such as peeling or cracking, to severe, involving materials that are difficult to weld. Generally, the impact of corrosion is detectable through all the senses, most commonly resulting in visual damage, odor, changes in color or smell, alterations in physical properties such as shape and surface texture, diminished service life, or reduced load-carrying capacity of the material. Material breaches caused by corrosion can serve as a starting point for mechanical damage, significantly decreasing fatigue resistance, making them a significant concern for modern industries.

In recent years, the electric vehicle sector has seen significant expansion. In order to ensure the longevity and performance of electric cars, it is essential to address factors such as protection from external elements, mechanical stress, driving range, energy efficiency, and resistance. Corrosion is a critical consideration in the development of electric cars, as it can depend on the materials used and the

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