

Advances in Corrosion and Protection of Materials

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1. Introduction and Scope

From an engineering standpoint, the corrosion of metallic materials is a challenging phenomenon, responsible for huge costs and serious failures. This situation has driven the quest for increasing scientific initiatives to improve the current knowledge on corrosion mechanisms and mitigation strategies in different areas. Hence, intense research activity is dedicated to develop new alloy compositions, protection methods, and to investigate corrosion mechanisms in depth.

As part of this scenario, this Special Issue was conceived to gather new, innovative contributions towards a deeper understanding of corrosion processes in a variety of applications.

2. Contributions

This volume collected 12 research papers devoted to different aspects of corrosion and its mechanisms. In the first paper, Seikh et al. [1] prepared low-Ni, Co-free maraging steels with varying Mo concentrations using an electroslog remelting process. The effect of Mo addition on the electrochemical behavior of the new maraging steels was investigated in H₂SO₄ and NaCl solutions. The corrosion resistance was improved with respect to the Mo-free steel, depending on the Mo content.

Queiroz et al. [2] compared the corrosion resistance of the AA2024-T3 and AA2524 T3 aeronautic Al alloys, giving emphasis to the interplay between microstructural aspects (presence of intermetallic compounds) and the electrochemical behavior of the alloys. The surface area of intermetallic compounds was associated with the localized corrosion susceptibility of the alloys.

The local and global corrosion behaviors of composite Ni-P-multiwalled carbon nanotube films obtained by electroless deposition on carbon steel substrates were studied by Oliveira et al. [3]. The addition of multiwalled carbon nanotubes increased the adhesion strength and reduced the electrochemical activity on the surface of the coated samples.

As ship hull steel is subject to severe corrosion attack, Zhang et al. [4] submitted a contribution towards understanding the corrosion mechanism of EH47 ship steel in seawater. Electrochemical tests and immersions tests (up to 80 days of immersion) were conducted. A mixed pitting corrosion and crevice corrosion mechanism was proposed, depending on the immersion time.

Li et al. [5] obtained a copper-rich surface on copper-bearing steels by wet/dry cyclic corrosion tests, thus forming an in situ composite material. The new copper-rich surface significantly increased the corrosion resistance of the copper-bearing steels.

Anodization is a traditional surface treatment for magnesium alloys. The effect of anodization parameters on the corrosion-fatigue behavior of structural Mg alloys is yet not well understood. The paper by Oliveira et al. [6] aimed to shed light on this topic. They investigated the corrosion-fatigue behavior of an anodized AZ31B Mg alloy in phosphate-buffered solution. The effect of the anodized layer on the fatigue resistance of the alloy is discussed.

Wang et al. [7] evaluated the effect of pH on the localized corrosion behavior of the L360 pipeline steel with and without S8 coating in a typical sour-simulated environ-



Citation: Antunes, R.A. Advances in Corrosion and Protection of Materials. *Metals* **2023**, *13*, 1059. <https://doi.org/10.3390/met13061059>

Received: 8 February 2023

Accepted: 14 February 2023

Published: 1 June 2023



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ment. An innovative wire beam electrode (WBE) was employed for studying the local corrosion processes.

The oxidation behavior of Fe-W-Cr-Zr steel with dispersed Fe₂Zr particles was studied by Chen and Rong [8]. This material is a candidate for advanced generation IV nuclear reactors. In this work, the authors characterized the composition of the oxide layer formed after oxidation tests in stagnant air and oxygen-saturated stagnant liquid Pb-Bi eutectic, as well as the influence of microstructural features on the scale growth rate.

Microbiologically induced corrosion (MIC) is a serious concern in oilfield production. The contribution by Welikala et al. [9] was focused on the study of biofilm growth by iron-reducing bacteria *Shewanella putrefaciens* on carbon steel and its effect on the corrosion behavior of the material in different culture media. They provided an in-depth evaluation of the effect of the IRB biofilms on the corrosion behavior of the carbon steel.

Aperador et al. [10] investigated the corrosion resistance of structural rebar embedded in non-Portland cement alkali-activated slag concrete. The effect of immersion time in chloride solution was investigated. The correlation between concrete porosity and corrosion resistance was discussed for the new cement composition.

Ductile cast iron used for water transmission pipelines are subject to corrosion. In the paper by Wang et al. [11], the effect of surface cracks on the corrosion resistance of a ductile iron casting was studied. They identified the main environmental factors that influence the corrosion behavior, such as oxygen solubility, temperature, pH, chloride concentration, and water hardness.

Howyan et al. [12] developed polystyrene/organoclay nanocomposites to investigate their corrosion protection ability as coatings for carbon steel parts. They used commercial Indian clay and Khulays clay as nanofillers. A corrosion protection efficiency of up to 81.4% was reached using the commercial clay at a filler loading of 1 wt.%. Dispersion of the nanoclays in the polymer matrix was the essential factor influencing the corrosion resistance of the coated samples.

Acknowledgments: As Guest Editor, I would like to thank all the reviewers and authors who contributed to this Special Issue. Special thanks are given to all MDPI staff for the professional, polite, and timely support in all publication steps.

Conflicts of Interest: The author declares no conflict of interest.

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