

Atmospheric Corrosion Resistance of Marine Biomineralized Layers on Aluminium – Magnesium Alloy

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Developing solutions to improve the durability of materials remains a key challenge in surface science, especially for aluminium and aluminium alloys. In this context, marine biomineralization processes have been shown to offer potential as a novel approach for developing more sustainable corrosion protection solutions ^[1,2]. These solutions are based on the spontaneous formation of biomineralized layers, which exhibit a hybrid inorganic-organic nature and are capable of mitigating the corrosion of aluminium alloys, specifically Al-Mg alloys ^[3,4].

The present study investigates the corrosion resistance, under natural atmospheric exposure conditions, of marine biomineralized layers formed on Al-Mg surfaces. More specifically, the evaluation tests were carried out at an outdoor marine/industrial test site (Sines, Portugal). Morphological and chemical characterizations were performed before and after the exposure, mainly by SEM/EDX and XPS, enabling the assessment of the Al-Mg surface modifications and the impact of the natural atmospheric corrosion test on the biomineralized layer.

A comparative analysis of Al-Mg surfaces with and without the presence of the marine biomineralized layer revealed clear differences in the corrosion attack of the alloy. Although the biomineralized layer showed some degradation under the tested conditions, the attack was less marked than in the absence of this layer. Overall, the results provide experimental evidence that the marine-induced biomineralization layer formed on the Al-Mg alloy can contribute to an improvement in corrosion resistance in a corrosive atmospheric environment.

This work highlights the possibilities of using biomineralization, as a microbiologically influenced corrosion inhibitor (MICI) mechanism, to develop corrosion protection solutions inspired by the marine environment.

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References

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