

Effect of marine microbial activity in corrosion inhibition of 5083 aluminium alloy

M. J. F. Marques^{a,b}, D. Mercier^c, A. Seyeux^c, S. Zanna^c, P. Marcus^c, R. Basseguy^a

^aLaboratoire de Génie Chimique, Université de Toulouse, CNRS, INPT, UPS, Toulouse, France.

^bLaboratório de Materiais e Revestimentos, LNEG – Laboratório Nacional de Energia e Geologia, Lisboa, Portugal.

^cInstitut de Recherche de Chimie Paris, Research Group Physical Chemistry of Surfaces (IRCP), Chimie ParisTech-CNRS, PSL Research University, Paris, France

Microbiologically influenced corrosion inhibition (MICI), can be considered as a new environmentally friendly strategy for corrosion inhibition. Nevertheless, at present, most of the findings in MICI research are obtained under optimized laboratory conditions, generally involving a single microorganism. To upgrade the knowledge in this research field and increase the potential applications, more studies under real conditions are needed, since environmental complexity and biological diversity coexist in field environments impacting the corrosion process of metal surfaces. In this context, one of the main objectives of the MICOATEC project (“New concept of Microbially Inspired anticorrosion coating technology”) is to understand the microbially induced formation of a protective layer on the Al-Mg surface during exposure in marine field. The present work is part of this study.

Several samples of Al-Mg (AA5083) were immersed at Genoa Outdoor Experimental Marine Station (GEMS) for different periods of time (15 days, 1, 2 and 6 months). After exposure, surfaces and interfaces, characterized by advanced analysis techniques as XPS, GD-OES, ToF-SIMS and SEM/EDX, revealed different surface modifications according to the immersion time and the side of exposure (light or dark). The type of biofouling has shown to influence the formation of the layer whose thickness and composition were different. The corrosion resistance of this naturally formed layer was evaluated by natural atmospheric exposure (Marine/Industrial Outdoor test site, Sines-Portugal). Morphological and chemical characterization by SEM/EDX, surface and cross-section, were performed before and after the natural ageing test. Correlations between the results of the ageing tests and the characterization of the layers were carried out to go further in the understanding of this protection phenomenon.

This work was financially supported by the ANR, in the framework of the MICOATEC project (ANR-19-CE08-0018).