Assessment of Anticorrosion Properties of Biomineralized Induced Coating formed on Al Alloy in Marine Environment.
A new Nature-Inspired Approach for Corrosion Protection.

M.J. F. MARQUES[1], T.C. DIAMANTINO[1], R. BASSEGUY[2]

1) Laboratório de Materiais e Revestimentos, LNEG – Laboratório Nacional de Energia e Geologia, Lisboa/Portugal
2 Laboratoire de Génie Chimique - Université de Toulouse, CNRS, INPT, UPS, France

Among the strategies employed to protect metallic materials, coatings can be considered as one of the most successful and cost-effective alternatives to efficiently increase the service lifetime of metallic structures, particularly in industries that are continuously exposed to changing and hard weather conditions such as shipbuilding, automobile, aerospace, marine and oil & gas energy infrastructures. However, towards a more constraining legislation as REACH, the surface treatment & coating Industry is at the forefront in developing innovative and even more sustainable products. In the anticorrosion domain, Nature is a fruitful provider of new concepts for green solutions.
Biomineralization is a widespread phenomenon that leads to the formation of different biological minerals and has been a large source of inspiration for a variety of fields, ranging from biotechnology, geotechnology, paleobiology to civil engineering and with relevant importance in biomedical research.
Comparatively, in the research area of Anticorrosive Coatings, biomineralization has been an underdeveloped approach. Recently, some scientific publications in the field of corrosion and protection have mentioned the advantage of biogenic mineral precipitation on materials surface protection [1, 2].
Notwithstanding these observations, mostly performed in laboratory, the fact that the biomineralization film formed on metal surface can reduce corrosion has been insufficiently explored and should be considered as novel and eco-friendly start-point to produce anticorrosion solutions.
Aluminium is currently the second most used metal in the world, providing advantages like low weight, maintenance costs savings, easy workability and recyclability. More specifically, the aluminium-magnesium alloy (Al-Mg) of the 5XXX series is commonly used in marine industry due to corrosion resistance. The main goal of this study is to prove the anticorrosive behaviour of naturally coating formed by biomineralization process on AA5083 alloy surface during estuarine exposure.
Experimental work included accelerated salt spray test performed on AA 5083 samples with 2 and 3 years of immersion in Tejo estuary and without exposure. Morphological and chemical characterisation by SEM/EDS, surface and cross-section, were performed before and after the accelerated ageing test.

[1] C. Cote, O. Rosas, R. Basseguy, “Geobacter sulfurreducens: An iron reducing bacterium that can protect carbon steel against corrosion?” Corrosion Science, 94, 2015.

[2] Yuanyuan Shen et al, “Study of pitting corrosion inhibition effect on Al alloy in seawater by biomineralized film“, Bioelectrochemistry, 132, 2020.