Antibacterial properties of three sol-gel type polymers aluminum alloys: Biocorrosion protection against *Pseudomonas aeruginosa.*

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Abstract

Microorganisms have a strong tendency to colonize solid surfaces, leading to a complex microbial community that strongly adheres to the substrate, called biofilm . Biofilms are detrimental to the underlying substrates, causing physical degradation or biodeterioration of the metal surfaces. This phenomenon is widely recognized as biocorrosion or microbiologically influenced corrosion. Among the many microorganisms which induce the degradation or corrosion of metallic materials, *Pseudomonas* is one of the most studied and it is associated with corrosion of aluminum and its alloys.

In this work, we studied the antibacterial capacity of three hybrid sol-gel coatings against *Pseudomonas aeruginosa* for protection against biocorrosion processes on AA-2024. The polymers were synthesized by mixing Tetraethoxysilane (TEOS) with three kinds of precursors, namely (a) trietoxipropilsilano (TEPRS), (b) trietoxipentilsilano (SOD) and (c) trietoxioctilsilano (TEOCS). The main difference between the three precursors is the length of the aliphatic chain of one of the substituents. The antibacterial properties were examined using viability techniques, mainly confocal microscopy, and the surface morphology and analysis were explored by scanning electron microscopy with EDX facilities. The resistance to microbiologically influenced corrosion of the uncoated and coated AA-2024 samples was evaluated by potentiodynamic polarization. The results reveal that the polymers possess antibacterial ability against *Pseudomonas* aeruginosa, and that the length of the carbon chain of one of the precursors does not significantly affect this property. In addition, the electrochemical experiments show that the coatings inhibit the microbiologically influenced corrosion in 0.1 M NaCl, revealing a correlation between the degree of protection and the length of carbon chain in the second precursor, while the longer the chain length, the greater the protective effect. The nature of the antibacterial ability resides mainly in the hydrophobic characteristic of polymers and pH changes occurring at the polymer-electrolyte interface when the coated aluminium alloy samples are immersed in the electrolyte.