11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

Electrochemical Studies of Ultrathin Films Deposited by Self-Assembly Technique

E. C. Gomes[(1)*], M. A. S. Oliveira[(1)]

(1) EAM-M, Instituto Tecnológico da Aeronáutica – ITA – Laboratório de Estudos de Corrosão, São José dos Campos – SP, e-mail: evertonquimica@gmail.com

* Corresponding author.

Abstract – In this work, polyaniline (PAni), a polycation, and poly (vinylsulfonic acid, sodium salt) (PVSS), a polyanion, were used to prepare PAni / PVSS multilayer self-assembly films on AA-2024 alloy surfaces. Potentiodynamic anodic polarization (PAP) and electrochemical impedance spectroscopy (EIS) tests were performed for uncoated and PAni / PVSS multilayer coated AA-2024 alloy surfaces in 0.1 mol NaCl L^{-1} aqueous solution. The electrochemical results showed that 08 is the number of self-assembly bilayers that offer better corrosion protection to the AA-2024 alloy in chloride containing medium.

Polyelectrolyte multilayers have been receiving considerable attention due to their widespread potential applications ranging from photodiodes to selective membranes, biomaterial and nanocapsules coatings. Various techniques have been developed to coat solid substrates with multilayer films, among them the layer by layer (LbL) polyelectrolyte deposition technique [1]. The major driving force for LbL deposition of polyelectrolyte multilayers is the electrostatic attraction between layers.

In this work deposition of multilayer films was performed by immersion of the substrate (AA-2024 alloy) in an aqueous solution of poly (vinylsulfonic acid, sodium salt) (PVSS). After some time of immersion (5 min), the substrate was withdrawn from this solution and dried in a hot air stream. Then, the substrate was immersed in an aqueous solution of PAni dissolved in concentrated formic acid (PAni-HCOOH) and after 5 minutes of immersion in this solution it was washed with deionized water and dried again in a hot air stream. The repetition of these two processes led to the formation of the multilayer films. Potentiodynamic anodic polarization (PAP) and electrochemical impedance spectroscopy (EIS) tests were performed, in aqueous solution of 0.1 mol L^{-1} NaCl, for both uncoated and PAni / PVSS multilayer coated AA-2024 alloy surfaces.

The potentiodynamic polarization tests for the aluminum alloy AA-2024 covered with different numbers PVSS / PAni bilayers showed that 08 is the number of self-assembly bilayer films that offer better corrosion protection for the AA-2024 alloy surfaces in chloride containing medium (Figure 1). The EIS results, presented in Figure 2 as Nyquist and Bode plots, showed that the impedance of surfaces coated with 05 self-assembly bilayer films is higher than that of the just polished AA-2024 alloy surfaces. For comparison, EIS results for aluminum alloy surfaces coated with 08 PAni / PVSS bilayers as well as the electrochemical parameters obtained by fitting the EIS results with equivalent electrical circuits will be presented at the Congress.

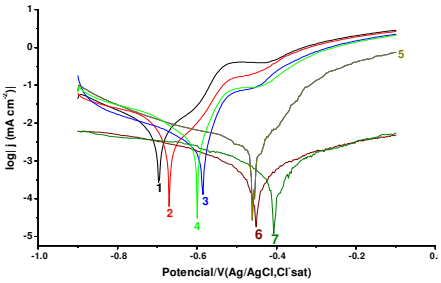
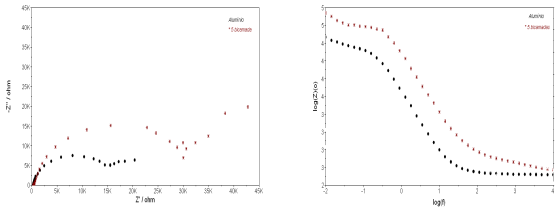


Figure 1: Potentiodynamic polarization curves for AA-2024 surfaces coated with a number n of PVSS/PAni self-assembled bilayers and exposed to 0.1 mol L^{-1} NaCl aqueous solution: (1) n = zero (just polished surface), (2) n = 1, (3) n = 5, (4) n = 15 (5) n = 9 (6) n = 7 and (7) n = 8.



(a) (b)

Figure 2: (a) Nyquist and (b) Bode plots for surfaces of the AA-2024 alloy coated with 05 PVSS/ PAni self-assembly bilayers and exposed to 0.1 mol L^{-1} NaCl aqueous solutions.

[1] C. H. Porcel, A. Izquierdo, V. Ball, G. Decher, J. C. Voegel and P. Schaaf Langmuir, 21 (2005) 800-802.