Chemical Deposition of Thin Films of Polyaniline on AA7075 and AA8006 aluminum alloys

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According to the classification system for aluminum alloys, adopted by the Aluminum Association, zinc is the main alloying element in the alloy AA7075 (Al-Zn-Mg-Cu), while for the alloy AA8006, the main alloying elements are Fe and Mn [1]. These elements are added to pure aluminum, to improve the mechanical properties, however, their presence leads to different corrosion characteristics. Polyaniline (PAni) films are protective coatings against corrosion having a barrier effect and anodic protection characteristics [2]. Different studies in the literature report the deposition of PAni on aluminum and its alloys by electrochemical techniques or "casting solution" (PAni solubilized in N-methyl-2-pyrrolidone) [3]. In the present work, polished samples of AA7075 and AA8006 were immersed directly in the reaction media of PAni syntheses. The polymer was synthesized using the procedure described by Manohar *et al.* [4] with modifications. The aniline (0.1 mol L^{-1}) was dissolved in 0.5 mol L^{-1} H_2SO_4 and the solution kept at 0 °C under stirring. Ammonium persulphate ($(NH_4)_2S_2O_8$) 0.1 mol L^{-1} was added to this solution. After 1.5 h of reaction, the samples recovered by PAni films were washed and dried. The morphology of the films formed on surface and the substrates were examined using optical microscopy, scanning electron microscopy (SEM) and atomic force microscopy (AFM). The formation of thinner and more adherent PAni films, on surface of alloys, when compared with films obtained by casting solution, were observed. Corrosion studies performed on AA7075 and AA8006 uncoated and coated with PAni films samples were performed using potentiodynamic polarization in 0.6 mol L^{-1} NaCl aqueous solution at 0.5 mV s^{-1}. The measurements were carried out with a potentiostat (EG&G PAR model 273A) and a saturated calomel electrode as reference. The corrosion (E_{corr}) and pitting (E_{pit}) potentials were, for bare AA7075, -0.768 V and -0.763 V, respectively, and for bare AA8006, E_{corr} = -0.913 V and E_{pit} = -0.681 V. When PAni is used as protective coating, E_{corr} and E_{pit} shift to more positive values compared to the samples without coating, providing anodic protection, furthermore the value of corrosion current decreases, i.e., the corrosion process occurs with lower speed. Thus, it is possible to conclude that chemical deposition is a simple and efficient method to obtain thin and adherent films of PAni on aluminum alloy surfaces, protecting them against corrosion processes.

Keywords: polyaniline, aluminum alloy, corrosion protection.

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