Pore Structure and pit formation during sulfuric anodizing of AA2024T3 alloy

Rodrigo Villanova & Luís Frederico P. Dick
Electrochemical Processes and Corrosion Laboratory
Federal University of Rio Grande do Sul, lfdick@ufrgs.br
Av. Osvaldo Aranha 99, 90035.190 - Porto Alegre, Brazil

The pore structure of the oxide layer resulting from the sulfuric anodizing of an AA2024T3 alloy and the mechanisms of pit formation during this process are studied in this work. Samples of dimensions 5 x 1 cm^2 were cut from a 1.2 mm thick AA 2024 T3 sheet. Prior to the anodizing, the samples were mechanically grounded and polished to 1μm with diamond paste. Anodizing was carried out in aqueous sulfuric acid solution (15% volume), at room temperature, with constant current density of 15 mA/cm^2 for different times (25, 45, 65 and 85 minutes). After anodizing, samples were characterized both by transmission and scanning electron microscopy, in cross-sectional and plan views. Obtained results show that the pore structure of the oxide layer resulting from such process conditions is quite imperfect, the pores are not regular and well defined, and they are interconnected. Several regions with “bubble-like” structure were observed, as well as holes within the oxide layer, resulting from the dissolution of precipitates by the electrolyte during the porous oxide growth. SEM plan views show that the pit formation at the oxide surface as a consequence of the chemical dissolution of the oxide by the electrolyte is also influenced by the presence of the precipitates in the metal matrix.

Fig. 1 shows the structure of the porous oxide layer, as observed in cross-section by TEM. It is possible to see that matrix precipitates are completely dissolved, leaving voids within the oxide. These voids continue to grow during the anodizing process showing up at the surface as larger cavities, as shown by the SEM plan views of Fig. 2.

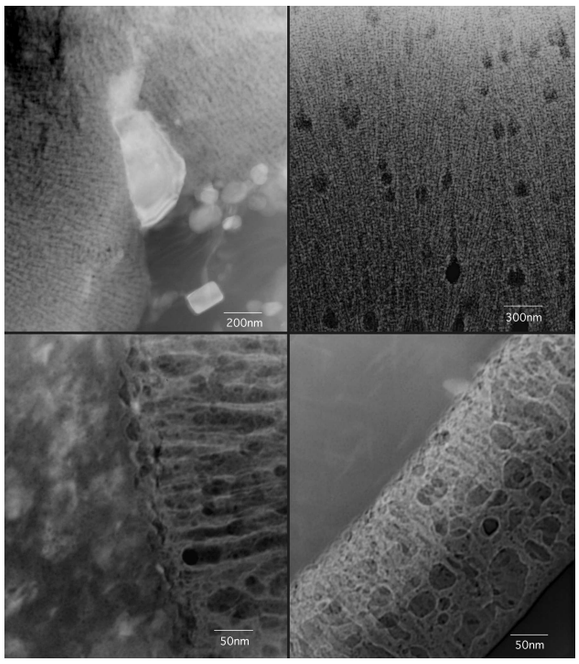

Figure 1. TEM micrographs showing oxide layer features.

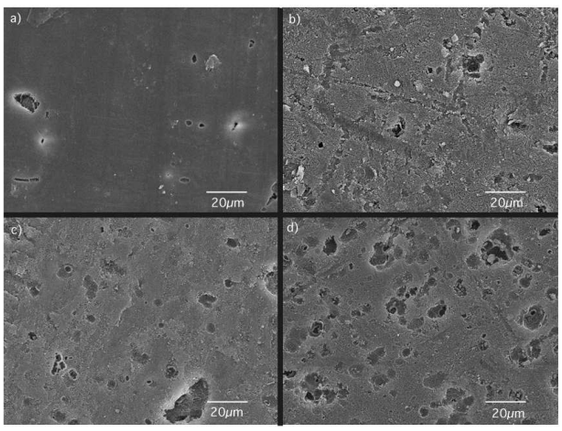

Figure 2. SEM micrographs showing holes formation on the surface of the oxide layer