Behavior of Si-Precipitates in Porous Anodized Al-Si Alloys

Stephen D. Carpenter & 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

By anodizing of Al-Cu alloys in neutral electrolytes, a compact oxide (barrier layer) is formed. It is well known that under these circumstances, Cu will not dissolve and will precipitate as particles embedded within the oxide or as a powder like deposit on the oxide surface. More recently, it has been shown for Al-Cu based alloys containing Al_2Cu precipitates [1] or for AA 2024 with complex ternary precipitates containing Al-Cu-Mn and Al-Cu-Mg [2] that in acid electrolytes the precipitates are completely dissolved resulting in holes in the oxide.
The behavior of Al-Si alloys during anodization to date has not been reported in the literature. In this work we studied the behavior of finely dispersed Si precipitates during the anodization of Al-Si based alloys.
Al-Si alloys usually contain an Al-Si eutectic that consists of faceted Si phase within an aluminum matrix. The aim is to develop a method to produce nano structured Si-particles within a dielectric matrix, as an alternative to the electrochemical method of producing porous silicon.

The eutectic microstructure of an 8 % and 12 % silicon Al-Si alloy was modifided by remelting and squeeze casting between two copper plates at ambient temperature. The objective of the squeeze casting technique was to produce a chilled or rapidly solidified microstructure. Subsequent anodizing was undertaken by polarizing galvanostatically, using 20 mA cm^{-2} in a 10 % H_2SO_4 solution at 20 °C, for different times. The results obtained from the SEM and TEM study during the characterization study are presented.

[1]X. Zhou, G,E. Thompson, P. Skeldon, G.C. Wood: *"Corrosion Science'*, 41 (1999) 1089-1094.
[2] R L. Villanova, H. P. Strunk & L. F. P. Dick: *'Role of Al-Cu-Mg and Al-Cu-Mn Precipitates in the sulfuric anodizing of the AA 2024 alloy* LATINCORR 2003 Santiago de Chile, Chile.