A COMPARATIVE STUDY OF CORROSION BEHAVIOUR OF DC AND PULSE ANODISED AA2024 ALLOY

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INTRODUCTION

To improve the corrosion resistance of aluminium and its alloys, oxide layers are produced on them and sealed with different type of sealing such as boiling water sealing (BWS), dichromate sealing (DS) and triethanolamine sealing (TEAS)[1]. A comparative study of the corrosion behaviour of anodised and sealed aluminium alloy formed in direct current and pulse current has been made.

In pulse anodising AA2024 aluminium alloy specimens were anodised at 75% duty cycle and the quality of the oxide film was better than DC anodising. The values of thickness, hardness, breakdown voltage showed higher values than DC anodising[2]. The corrosion resistance of the oxide film after sealing in different sealing agents has been studied and the data are presented in this paper.

EXPERIMENTAL

Aluminum panels of AA2024 of size 5cm x2cmx0.1cm were used in the present study. Samples were anodised in 150 gpl sulphamic acid at a current density of 2A/dm^{2}and at a temperature of 30^{0}C.Then they were sealed with different sealing solutions such as BWS, DS, TEAS for 15 minutes. The temperature of BWS, DS was 95-98^{0}C and that of TEAS 65-70^{0}C respectively. The sealed samples were exposed to 3% NaCl solution for different hours impedance measurements were done using Electrochemical Impedance Analyzer Model 398 from 10mHz to 100KHz.

RESULTS AND DISCUSSION

Figure1 compares the impedance behaviour of the DC and pulse anodised samples for 140 hours of exposure after TEAS, and from this it is clear that pulse anodised and sealed in TEA samples have more corrosion resistance compared to DC andised and TEA sealed samples. From the variation of phase angle with frequency for the anodised samples studied, (figure not given) it is clear that the variation in phase angle in pulse anodised TEAS is less when compared to BWS and DS. In case of BWS the formation of pits is evident from the impedance spectra where rapid changes in phase angle indicate the BWS is inferior to TEAS.

The equivalent circuit assumed to describe the impedance behaviour is given in Scheme1,wherein the R_b and C_b are the resistance and capacitance of the inner barrier layer.R_p and C_{dl} are resistance and capacitance of porus layer. Using this Scheme the simulation was made for AA2024 in TEAS and it is shown in figure 2. It is clear that the simulated and experimental values agree very well.

Table 1 gives R_p and C_{dl} values of the anodised AA2024 samples for different sealing agents different hours of exposure in 3% NaCl solution. From this table, it is evident that pulse anodising prove to be the best technique when compared to the DC anodising. The R_p values for anodised samples are very high short during initial hours of exposure in NaCl, and this is evident from, C_{dl} values which are very low. From the above results TEAS is the best sealing in both DC and Pulse anodising.

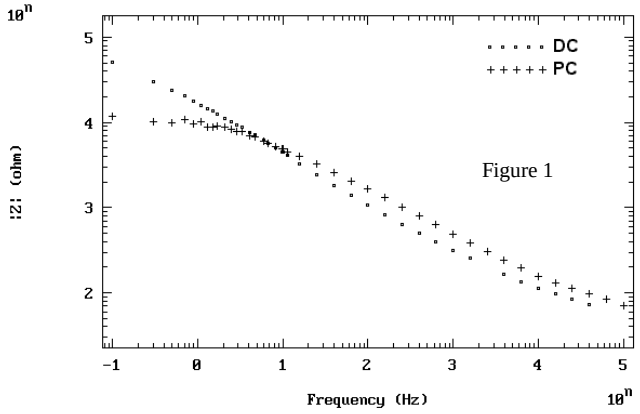


Figure 1

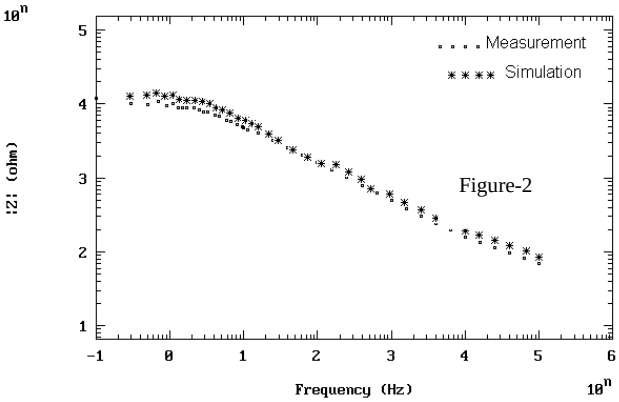
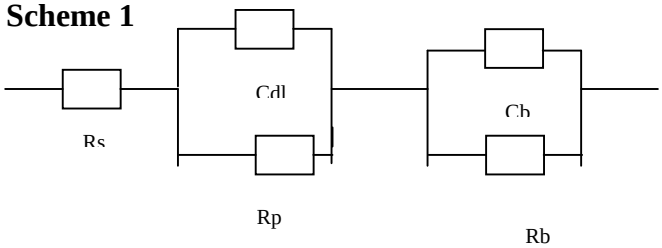


Figure-2

Table-1.

Type of sealing	Hours of Exposure (Hours)	R_p (K Ohms)	C_{dl} (farads)
Direct current			
Dichromate sealing	0 140	2.86 1.051	3.699e-6 1.32e-5
TEA sealing	0 140	3.85 1.320	3.511e-6 8.97e-6
Boiling water sealing	0 140	1.475 0.909	5.558e-6 5.20e-5
Pulse current			
Dichromate sealing	0 140	3.25 1.38	2.688e-6 9.75e-6
TEA sealing	0 140	4.461 1.661	2.43e-6 8.7e-6
Boiling water sealing	0 140	1.9 1.066	4.7e-6 9.2e-6

Scheme 1



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