CHARACTERIZATION OF THE CORROSION PROCESS OF THE ZINC IN PRESENCE OF CONTAMINANTS USING DC AND EIS TECHNIQUES.

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ABSTRACT

This communication reports on the corrosion rate of zinc plates (99.995% Zn) using electrochemicals techniques in DC and EIS. The main object of this study is to develop the effect of the chloride and sulphate ions in a great range of concentrations (from 0,05 to 1 M) using Na_2SO_4, NaCl, and $NaCl+Na_2SO_4$ solutions. It is simulated the main pollutant agents in the atmosphere of Canary Islands (anions SO_4^{2-} are very significative oxidant agents in industrial atmospheres and anions Cl- are important in marine atmospheres too). The electrochemical cell used in this study had a working area of 5.56 cm^2 (fig.1). It was used a platinum mesh which was inside the cell as a counterelectrode, and a saturated calomel electrode. The measures conditions were, once the potential was stabilized (after circa 100 min. approximately), a sweeping of frequencies of 1 mHz to 100 kHz.

In this work it is observed that the zinc has a high sensibility to the ions SO_4^{2-} diminishing the resistance to the corrosion as the concentration of this ions increases. In the behaviour of zinc in sulphates, the formation of semi-stables corrosion products are observed, not in chlorides.

In a general way with the mixture of Cl^- + SO_4^2, zinc is dissolved forming barely protective, soluble and less dense products of corrosion. The anions that elevate the acidification of the surface forming more soluble salts of zinc that the oxide of zinc and the hydroxides, reducing the stability of the pasivation.

In 0,4 M Na_2SO_4 and 0,8 M Na_2SO_4 solutions pasivation phenomena are described. Besides, in mixed solutions the effect of anions SO_4^{2-} and Cl^- are synergistic. The anion SO_4^{2-} domains the corrosion behaviour of zinc. In 0.2-0.5M range, EIS was use for developing the corrosion process in the pasivation zone. In the modelling of the data an equivalent circuit R(Q(R(QR))) was used (fig.2) The software used was Zsimpwim. In fig. 3, variations in the values of the different parameters are shown.

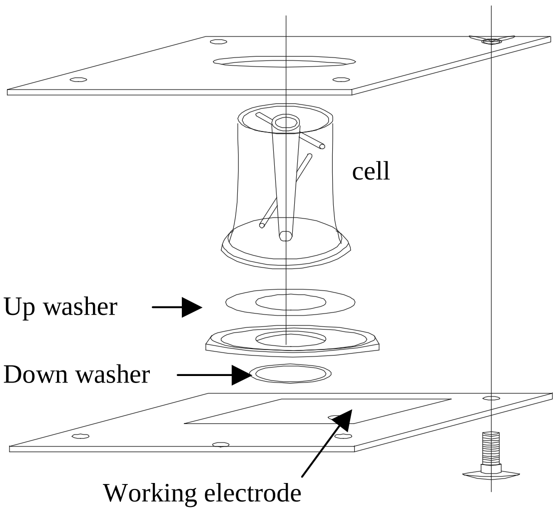

Fig. 1: Electrochemical cell used in the experiments. It has a working area of 5.56 cm^2 with glass cell and compound inferior support by three washers, two rubber and a rigid of teflon that guarantee the watertightness of the system.

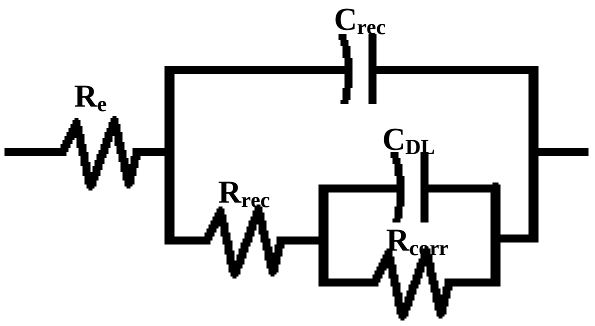

Fig. 2: Equivalent circuit, used for modeling the impedance data, where R_e is the resistance of the electrolyte, C_{rec} is the capacity of the corrosion products, R_{rec} is the resistance of the corrosion products, C_{DL} is the capacity of the double layer and R_{corr} is the resistance to the load transfer.

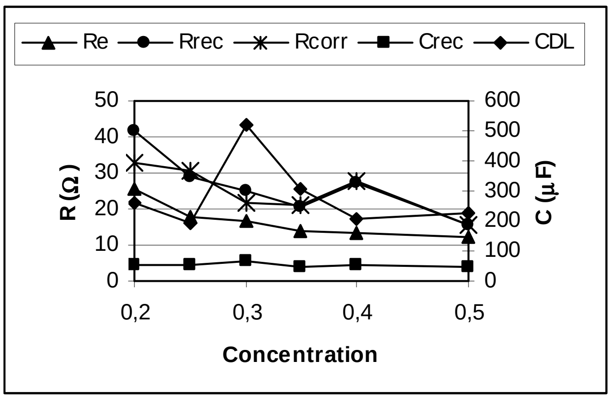

Fig. 3: Variation of the different parameters of the equivalent circuit in a concentration range of 0.2-0.5M.