

## ABSTRACT

Ninety-five percent of phosphoric acid is obtained by the wet process. The main stages in this process involve the attack of phosphate ore by concentrated sulphuric acid, filtration and concentration of acid. This technique generates severe corrosion problems due to the presence of impurities such as chlorides, fluorides and sulphides, as well as temperature and their concentration in the solution.

Polarisation curves at different temperatures showed that the material is in the passive state over a wide range of potentials. The kinetics of passive film formation was studied using potentiostatic tests conducted within the passive-range potentials. The electrical behaviour of the passive films formed on Alloy 31 was evaluated by electrochemical impedance spectroscopy (EIS) and Mott-Schottky analysis. Afterwards, the electrical behaviour of the passive films formed on Alloy 31 was evaluated by electrochemical impedance spectroscopy (EIS) and Mott-Schottky analysis.

The experimental data obtained by EIS were used to define the physical modelling of dissolution and passive film formation. The equivalent electric circuits explained the bilayer structure of the passive films formed on the Alloy 31 surface, as well as the diffusion processes, which were observed under the most severe conditions. The EIS results revealed the harmful effects of both, temperature and fluoride ions in the solution.

Mott-Schottky analysis was used to evaluate the semiconducting characteristics of the passive films. The results indicated an n-type semiconducting behaviour of the alloy due to the formation of insoluble Molybdenum oxide ( $\text{MoO}_3$ ) and other oxides, such as  $\text{Fe}_2\text{O}_3$ . Occasionally, the metal also showed a p-type semiconducting behaviour due to the presence of  $\text{Cr}_2\text{O}_3$ ,  $\text{FeO}$  and  $\text{NiO}$ . XPS analysis revealed the presence of these compounds on the Alloy 31 surface.

Finally, micro-electrochemical techniques were used to evaluate the weld of Alloy 31 in a 35 g/l NaCl solution. The results showed that the weld zone had a greater electrochemical activity and, consequently, was more susceptible to corrosion. The microstructural analysis of the alloy showed an increase in the segregation of alloying elements at grain boundaries.