

THE PITTING CORROSION OF MILD STEEL IN CHLORIDE
CONTAINING SOLUTIONS.

C.M.Rangel¹, M.H.Simplicio¹ and M.G.S.Ferreira².

¹Departamento de Tecnologia de Materiais
Corrosão e Protecção de Materiais - LNETI
Azinhaga dos Lameiros à Estrada do Paço do
Lumiar 22
1699 LISBOA CODEX - PORTUGAL

²Departamento de Eng^o Química - IST
1096 LISBOA CODEX - PORTUGAL

The existence of a threshold value for the anodic potential below which pitting corrosion does not occur is recognized, for a given system, as one of the characteristic features of this type of localized attack.

Fig 1 shows typical polarization curves for mild steel in normally aerated NaCl solutions at room temperature. Three anodic peaks are evident together with a rather short "passive region" that extends into a breakdown region characterized by a breakdown potential (Eb).

A potentiostatic study of the localized corrosion of mild steel in 10⁻³M NaCl solutions carried out together with Scanning Electron Microscopy (SEM) of the exposed surfaces, demonstrated that pitting corrosion might be initiated well below the breakdown potential.

The progression of the phenomenon with applied potential up to the breakdown region was followed by AC Impedance measurements.

Up to potentials in the vicinities of -650mV(SCE) the results indicated that a diffusion process is taking place. When the potential is increased to -550mV the diagrams show an undercut semicircle which has been

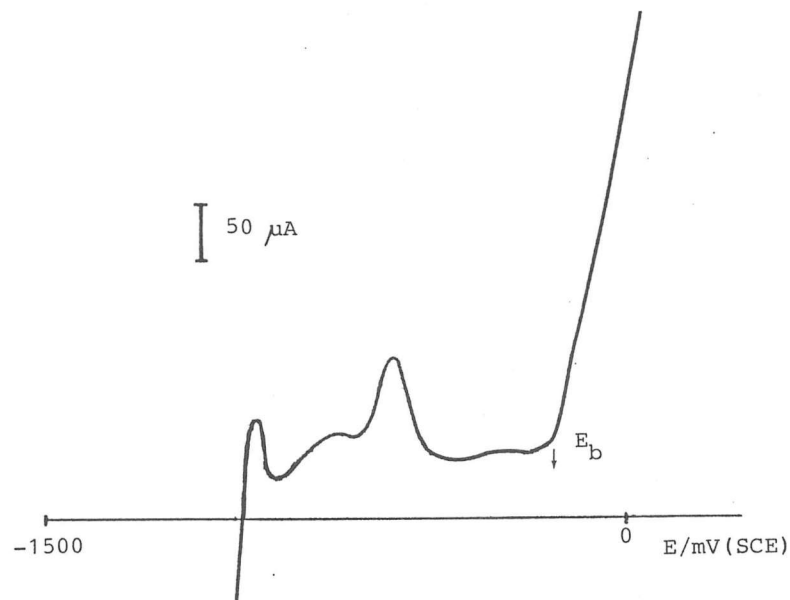


Fig 1. Polarization curves for mild steel in $10^{-3}M$ NaCl solutions at room temperature, $V=12.5mV \cdot s^{-1}$; exposure time before polarization=10 min; $A=0.70cm^2$.

attributed to the initiation of pitting in other systems^[1] (see Fig 2a). SEM observations at the same potentials confirmed the presence of pitting. However, at higher potentials repassivation of these pits sets in ^[2].

When the potential approaches $-250mV(SCE)$ pit propagation is observed (Fig 2b). AC Impedance plots show a semicircle that could be ascribed to charge transfer dissolution. With further increase in polarization (Fig 2c) the pits continue propagating and results show evidence of a process controlled by charge transfer and diffusion.

The results point out that pitting corrosion of mild steel occurs in the active region and that it might be related to the attack of sulphide inclusions as suggested by EDAX analysis.

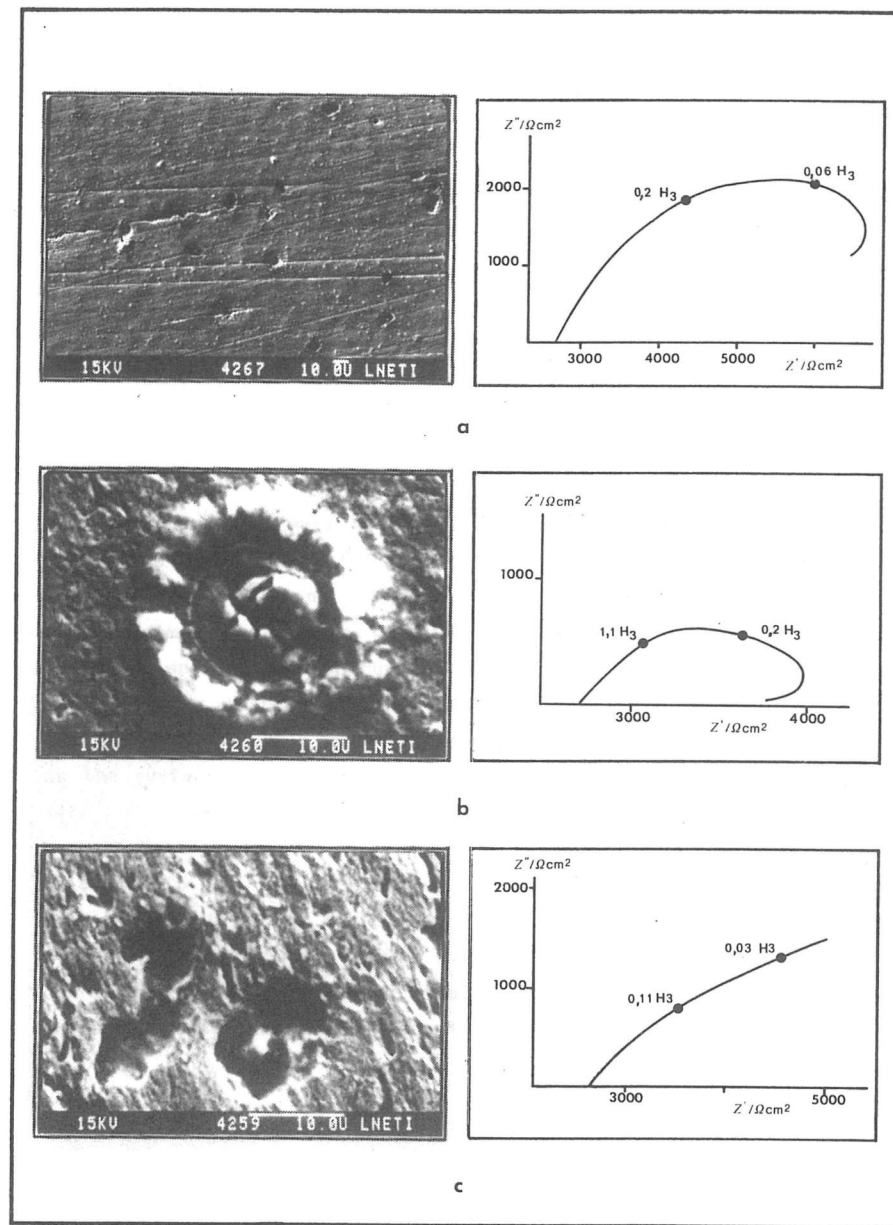


Fig 2. AC Impedance diagrams and morfology of attack for mild steel in $10^{-3}M$ NaCl at $-550mV(a)$; $-250mV(b)$; $-225mV(c)$. (Potentials are referred to SCE).

REFERENCES

- 1- M.G.S.Ferreira and J.L.Dawson, Corros.Sci, 26, 1009, (1986).
- 2- C.M.Rangel, M.H.Simplicio and M.G.S.Ferreira, "Factors influencing the pitting corrosion kinetics of mild steel in neutral solutions" (to be submitted).

INFLUENCE OF OXYGEN DIFFUSION ON THE MECHANISM
OF CORROSION PROCESSES UNDER THIN ELECTROLYTE FILMS

M. Júlia Justo¹, Mário G.S.Ferreira² e M.Elisabete Almeida¹

¹SCPM-DTM-LN/ETI, Az. dos Lameiros, 1600 Lisboa.

²Departamento de Eng^a Química e CECUL, Instituto Superior Técnico, 1096 Lisboa Codex.

In previous work (1), by using impedance measurements and zero resistance ammetry on Fe/Fe(ACM) multilaminar cells identical to those built by Kucera (2) and Mansfeld (3), a bilogarithmic correlation was found between the charge transfer resistance as estimated from the impedance spectra and the current density flowing between the two sets of electrodes of the cell. That law was valid for drying times over seven hours after a 1 mm thick sulphate electrolyte layer was placed on the surface of the cell, this simulating SO₂ polluted atmospheres (4).

However for low drying times (<7 hours) the above mentioned relationship was not followed, in spite of an increase in current density with time for periods over 3 hours. In Fig.1 results of the current density versus drying time are shown for concentrations corresponding to 50 µg SO₂/m³ of air. For other concentrations of SO₂ the same trends were found.