

# Corrosion of silver in natural and artificial sea water

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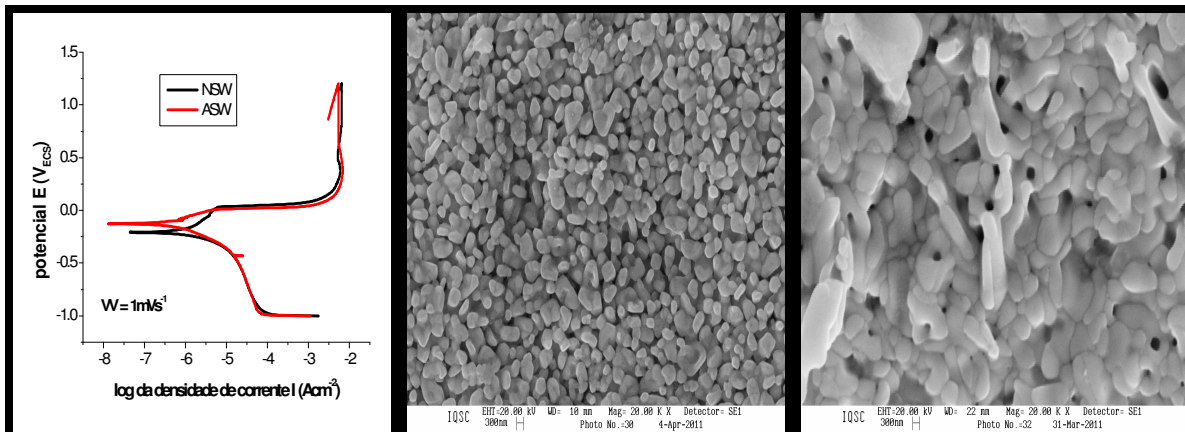
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The corrosive action of the natural sea water (NSW) is not restricted as the action of an artificial saline solution (ASW), whose electrochemical reactions take place usually on the interface between the metal and corrosive medium. These reactions modify the surface, producing regions with very different structures and subjected unequally to a corrosive attack. Secondary Electron Microscopy (SEM) shows distinct layers on the silver surface, as the product of potentiodynamic polarization, when testing is performed in natural (pH = 7.3) or artificial sea water (3.5% NaCl, pH = 7.0). The electrochemical parameters obtained from the polarization curves analysis indicate that the most aggressive medium is NSW, with a polarization resistance ( $R_p$ ) of 58 K $\Omega$  and corrosion rate of  $1.32 \times 10^{-3}$  mm/year. In natural sea water (NSW) the corrosion product consists of crystals with a more regular morphology and with nano-metric dimensions; while in artificial sea water (ASW), the crystals are elongated, connected with each other forming small channels and built up with micro-metric dimensions as shown in Fig. 1.

**Keywords:** Corrosion, Silver, Natural and artificial sea water.

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**Figure 1-** Potentiodynamic polarization curves of silver in NSW and ASW (left); nano silver-chloride crystals in NSW (middle) and micro silver-chloride crystals in ASW (right).

[1] GENTIL, V., CORROSÃO, Rio de Janeiro: Brasil, LTC - Livros Técnicos e Científicos Editora S.A., pp. 43-49, 2007.

[2] PAYER, J.H., et al., "Role of transport properties in corrosion product growth", Science Engineering A (198):91-102, 1995.

[3] HUNG, H., PAYER, J., "The effect of silver chloride formation on the kinetics of silver dissolution in chloride solution", Electrochimica Acta (56):2781-2791, 2011.

[4] WOLYNEC, S., TÉCNICAS ELETROQUÍMICAS EM CORROSÃO, São Paulo: Brasil, Edusp – Editora da Universidade de São Paulo., pp. 87-146, 2003.

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