



The electrochemistry in the biodegradation of metallic materials

D. Féron

Commissariat à l'Énergie Atomique, Saclay, France (damien.feron@cea.fr / Fax : +33 16908 1586 / Phone : +33 16908 2065)

The biodegradation of metallic materials is often called Microbially Influenced or Induced Corrosion (MIC) or Biocorrosion. This biodegradation is the result of uncontrolled factors linked to (1) the aqueous media which is generally supposed non corrosive, (2) the metallic material which is chosen for its predicted good behaviour in the liquid media, and (3) the micro-organisms (often bacteria) which are more often not expected.

In a first part, we propose to recall the fundamental mechanisms of the corrosion phenomena on the basis of the ISO Standard 8044: in liquid water, corrosion is an electrochemical phenomenon with anodic and cathodic reactions. Then the effects of bacteria are investigated through the "3M" analysis which tries to link media, material and micro-organisms parameters with the rates of the anodic or cathodic reactions. Focus will be made on the development and the importance of the biofilms on metallic surfaces and the catalysis or the inhibition of electron exchanges by this biofilm which lead to a localisation of the degradation (localised corrosion) and also to an increase (or less often decrease) the overall corrosion rates.

Illustrations will be taken mainly from the mechanisms of the biocorrosion of steels (carbon steels and stainless steels) in natural environments (sea or river waters, soils, ...) in aerobic or anaerobic conditions.

Conclusive remarks will include the measurements and the mitigation of the biodegradation of metallic materials where electrochemical techniques are widely used.