



HAL
open science

Local analysis of aerobic biocorrosion of stainless steel by scanning vibrating electrode technique

Hicham Iken, Luc Etcheverry, Alain Bergel, Régine Basséguy

► **To cite this version:**

Hicham Iken, Luc Etcheverry, Alain Bergel, Régine Basséguy. Local analysis of aerobic biocorrosion of stainless steel by scanning vibrating electrode technique. Biocorys 2007, Jun 2007, Paris, France. pp.0. hal-04030444

HAL Id: hal-04030444

<https://hal.science/hal-04030444>

Submitted on 15 Mar 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**Inquiries form
for abstract submission
for BIOCORYS 2007**

Family name of the **presenting author** : IKEN

First name : Hicham

Company / Institution : Laboratoire de Génie Chimique UMR5503

Department / Service : BioSym

Address : 5 rue Paulin Talabot BP 1301 Toulouse cedex 01 France

Zip code : 31106

Town : Toulouse

Country : France

Phone : (33) (0) 534615252

Fax : (33) (0) 534615253

E-Mail : Hicham.Iken@ensiacet.fr

Title of the abstract : Local analysis of aerobic biocorrosion of stainless steel by
Scanning Vibrating Electrode Technique

Co-authors :

IKEN Hicham

E-mail : Hicham.Iken@ensiacet.fr

ETCHEVERRY Luc

E-mail : Luc.Etcheverry@ensiacet.fr

BERGEL Alain

E-mail : Alain.Bergel@ensiacet.fr

BASSEGUY Régine

E-mail : Regine.Basseguy@ensiacet.fr

LOCAL ANALYSIS OF AEROBIC BIOCORROSION OF STAINLESS STEEL BY SCANNING VIBRATING ELECTRODE TECHNIQUE

Hicham IKEN^a, L. ETCHEVERRY^a, Alain BERGEL^a, Régine BASSEGUY^a

^a *Laboratoire de Génie Chimique UMR 5503 CNRS, 5 rue Paulin Talabot BP 1301, 31062 Toulouse, France, Tél : (33) (0) 534615252, Fax : (33) (0) 534615253
Hicham.Iken@ensiacet.fr*

ABSTRACT

Mechanisms of biocorrosion of stainless steels in aerobic natural waters are still discussed although it is commonly agreed that the biofilm catalyses the cathodic reduction of oxygen [1-2]. Several hypotheses have been proposed to explain this catalysis: formation of hydrogen peroxide [3], modification of the oxide layer on material surface [4], presence of biological molecules (enzymes as peroxidase, catalase...) that intervene in the different steps of oxygen reduction. This last hypothesis has been focused in our group [5].

The objective of this paper is to demonstrate the ability of the scanning vibrating electrode technique (SVET) to determine the areas where this catalysis may occur. The SVET allowed establishing a map of the local currents flowing from the anodic and to the cathodic sites initiated on the surface. The experimental procedure was first designed with carbon electrodes and then extended to stainless steel. A strict protocol was defined to prepare the stainless steel and carbon electrodes by deposition of hemin on the surface. Hemin is a porphyrin compound similar to the active site of numerous oxidases (catalase, peroxidases...), which intervene in the reduction of oxygen and hydrogen peroxide. SVET was implemented on simple surfaces where a local galvanic coupling was created by depositing the catalyst on defined surface areas. Different local configurations were analysed, which clearly demonstrated the possible catalytic effect of adsorbed porphyrin in aerobic corrosion of stainless steel.

- [1] A. Mollica and A. Trevis. Proc. 4th Int Congress on marine corrosion and fouling, Antibes, France (1976) 351-365.
- [2] V. Scotto, R. Di Cintio and G. Marcenaro, Corrosion Science 25 (1985) 185.
- [3] I. Dupont, D. Féron and G. Novel International biodeterioration and biodegradation 41 (1998) 13.
- [4] N. Le Bozec, C. Compère, M L'Hers, A.Laouenan, D Costa and P. Marcus. Corrosion Science 43 (2001) 765.
- [5] M.E. Lai and A.Bergel, Journal of Electroanalytical Chemistry 494 (2000) 30.

Keywords : SVET, aerobic biocorrosion, hemin, stainless steel, carbon.