

# **Patterning of polystyrene by Scanning Electrochemical Microscopy. Biological applications to cell adhesion.**

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## **Supporting Information**

### **FEMLAB Simulation.**

The steady-state profiles of dimensionless concentrations of a species, generated at a microelectrode, and computed at the surface of an insulating substrate were deduced from the resolution of the diffusion equations by the finite elements method (FEMLAB<sup>  </sup> version 3.1, COMSOL France, Grenoble, France). The simulations were carried out on axisymmetric electrodes and the resulting problem was computed under 2D-axisymmetric geometry. In dimensionless form, the electrode has a radius unity ( $a = 1$ ) and  $RG = 5$  is chosen as the dimensionless radius of the insulating part of the electrode, the substrate is held at the dimensionless distance  $L = 0.2$ . The far-field boundaries are taken as  $R_s = 200$  and  $-Z_s = 200$ .

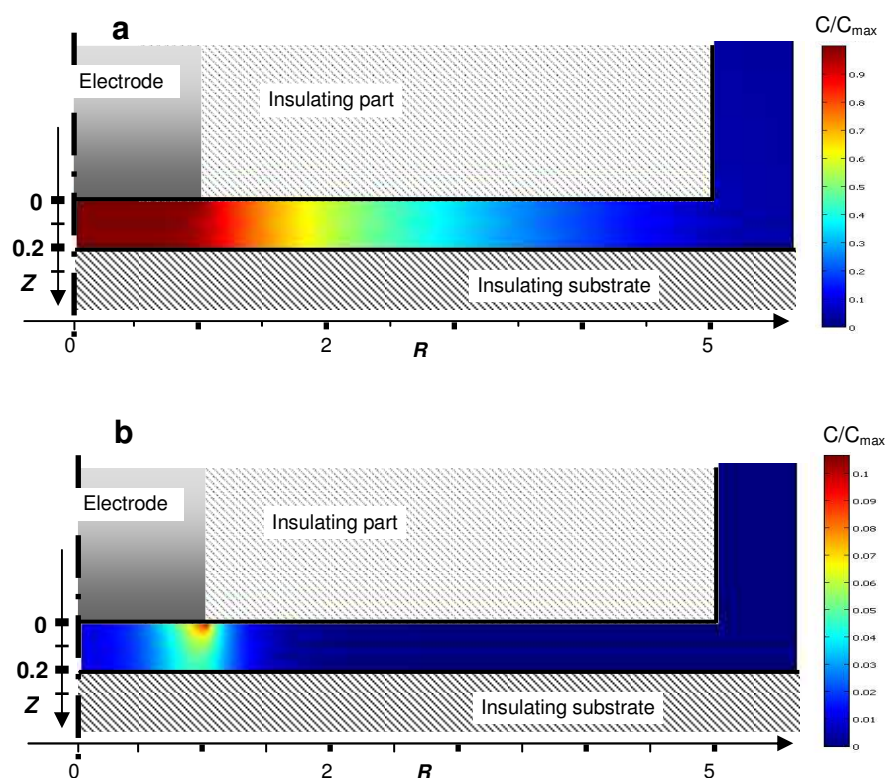
The simulation consists of the numerical solution of the diffusion equations coupled to chemical reaction of the electrogenerated species under the appropriate boundary conditions. In a typical case, Red is transformed into Ox at the SECM tip and Ox is engaged in an irreversible first-order reaction to generate an electro-inactive product P at a rate  $k_c$ .



The concentration distribution of Red, Ox and P are related from mass conservation and considering only two components for the simulation of the concentration distribution is self-

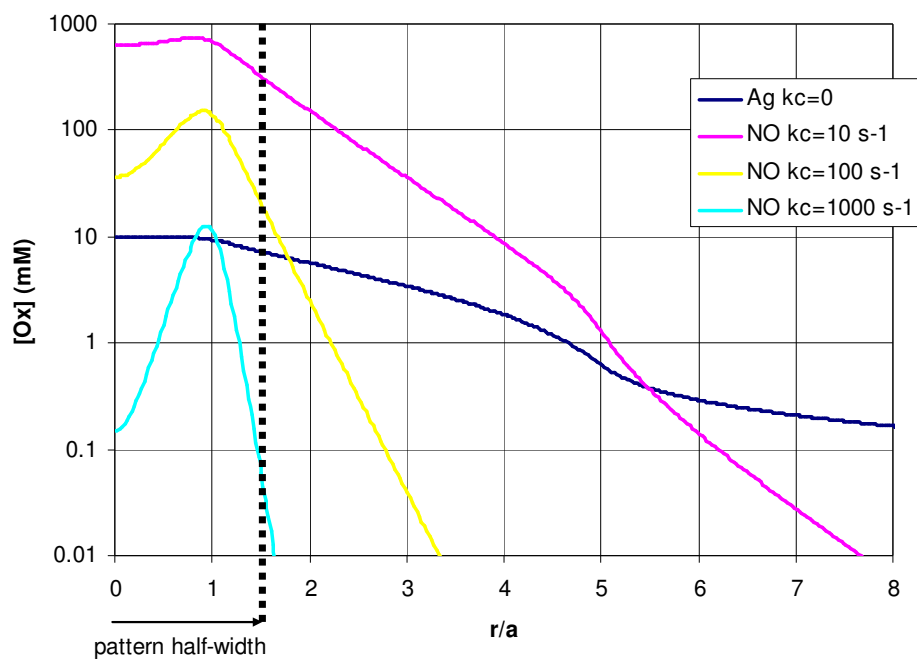
consistent. For more details concerning the boundary conditions and the formulation of the problem, the theoretical development of such situation has been already described.<sup>1</sup>

Fig SI.1a and SI.1b present the dimensionless concentration profiles between the tip and the substrate for Ox with decay rate  $k_c = 0$  and  $100 \text{ s}^{-1}$  respectively. Fig SI.2 shows the concentration of different oxidants at the substrate surface as a function of the radial distance from the tip center. For Ox =  $\text{Ag}^{2+}$ , a value of  $k_c = 0 \text{ s}^{-1}$  with a limiting concentration  $C_{\text{max}}$  of 10 mM were used while 3 values of  $k_c$  were assayed for Ox =  $\text{NO}_3^\bullet$  ( $k_c = 10, 10^2$  and  $10^3 \text{ s}^{-1}$ ) with a limiting concentration  $C_{\text{max}} = 3.25 \text{ M}$ .

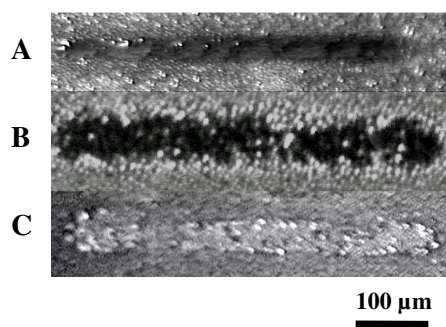


**Figure SI.1.** Concentration distribution of (a) stable or (b) unstable ( $k_c = 100 \text{ s}^{-1}$ ) electrogenerated etchants between the SECM tip and the etched substrate considered as an insulating substrate.

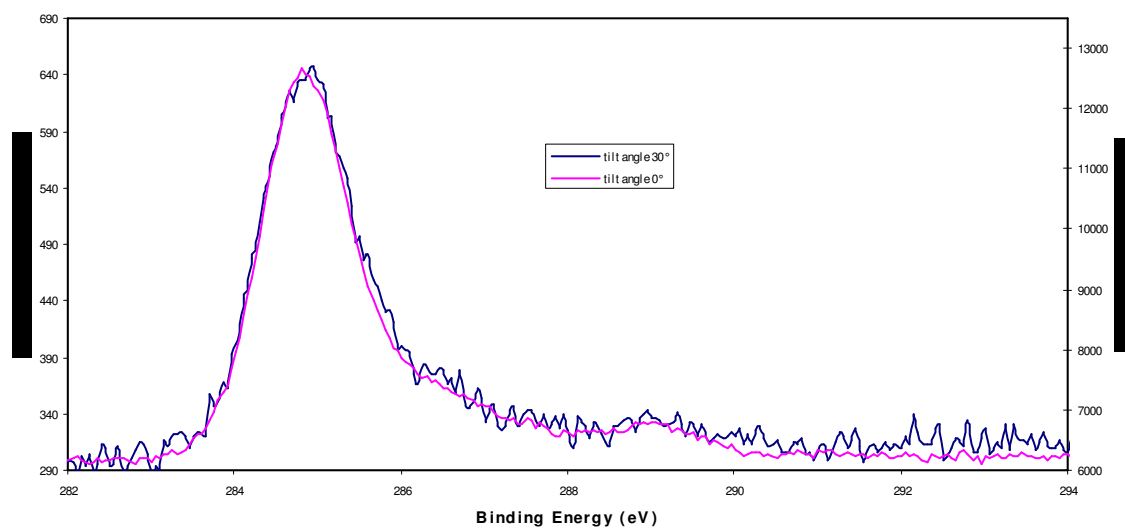
<sup>1</sup> a) Unwin, P. R.; Bard, A. J.; *J. Phys. Chem.* **1991**, 95, 7814. b) Kanoufi, F.; Cannes, C.; Zu, Y.; Bard, A. J. *J. Phys. Chem. B* **2001**, 105, 8951.



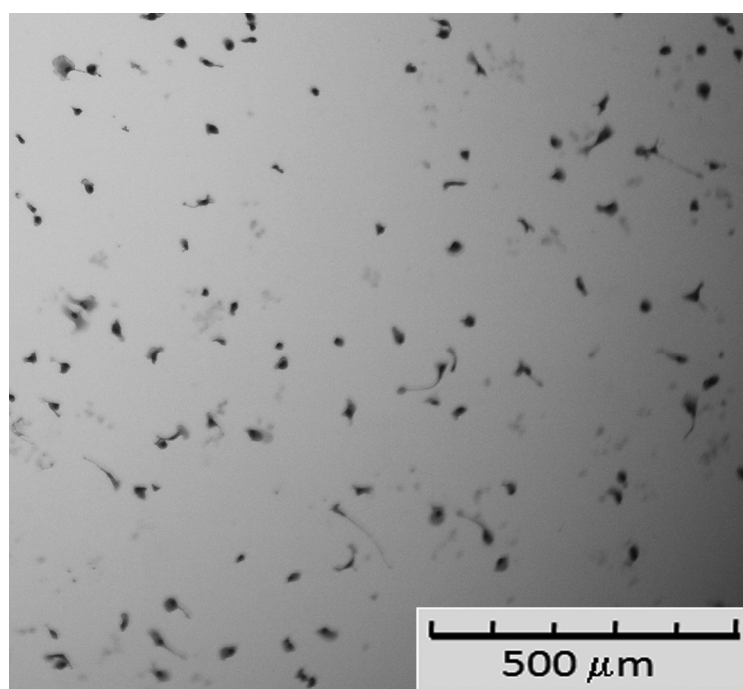
**Figure SI.2.** Concentration profiles of  $\text{Ag}^{2+}$  or  $\text{NO}_3^\bullet$  oxidants with different chemical stabilities along the radial axis at the substrate surface. Comparison with the pattern half-width formed with electrogenerated  $\text{NO}_3^\bullet$ .



**Figure SI.3.** Water condensation figures on PS surfaces modified by SECM. Tip scan rate :  $2 \mu\text{m s}^{-1}$ ,  $d \sim 3 \mu\text{m}$ . Electrogenerated reagents: **A:**  $\text{NO}_3^\bullet$ , **B:**  $\text{Ag}^{2+}$ , and **C:**  $\text{OH}^\bullet$ .



**Figure SI.4.** Angle-resolved XPS analysis of a PS oxidized surface. High resolution C1s peak. pink: 0°, blue:30°.



**Figure SI.5.** Mouse spleen cells after 7 days in culture on patterned PS Petri dish. May Grünwald Giemsa staining.