

## Microfabricated Scanning Probes for ECSTM and SECM

V. Auger<sup>1</sup>, N. Eichenberger<sup>2</sup>, T. Akiyama<sup>1</sup>, N. F. de Rooij<sup>1</sup>, H. Siegenthaler<sup>2</sup>, M. Koudelka-Hep<sup>1</sup>

<sup>1</sup>University of Neuchâtel, Institute of Microtechnology, 2007 Neuchâtel, Switzerland

<sup>2</sup>University of Bern, Department of Chemistry and Biochemistry, 3012 Bern, Switzerland

Microfabrication techniques are now routinely used to make planar microelectrodes and microelectrode arrays. However, the microfabrication of 3-dimensional metallic tip microelectrodes is still in early stages of development. [1,2] Such 3-d microelectrodes can be of interest in many electroanalytical areas with the most obvious being the scanning probe microscopies such as ECSTM and SECM.

The aim of our work is to implement the most convenient technology for making reproducible and well-controlled Pt-tips microelectrodes together with the possibility to realize probe arrays. An integration of these two techniques, such as demonstrated recently for the AFM/SECM [3] will also be investigated.

In this contribution we report on the fabrication of 50  $\mu\text{m}$  high Pt-tips using silicon anisotropic etching, thin-film Pt and silicon nitride deposition and patterning. Different technologies used for the opening of the silicon nitride passivation layer [4,5] allowed active areas ranging from 0.03  $\mu\text{m}^2$  to 600  $\mu\text{m}^2$  to be obtained. An SEM photograph of a tip (radius of curvature 0.2  $\mu\text{m}$ ) is shown in figure 1.

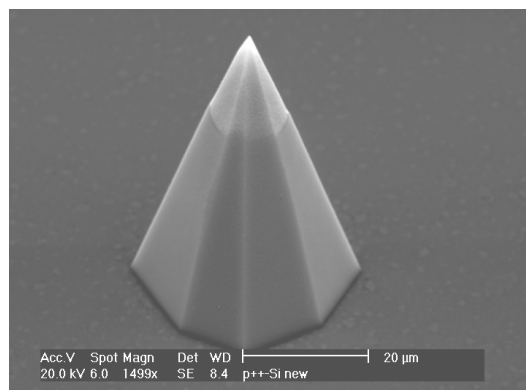


Fig 1 : SEM photograph of a 50  $\mu\text{m}$  high Pt-tip

The tips have first been characterized by cyclic voltammetry of ferrocyanide (fig. 2) or  $\text{Ru}(\text{NH}_3)_6^{3+}$  in a 1 M KCl solution and observed by SEM. The experimentally measured limiting current values allow the cone radius to be estimated. Assuming a spherical diffusion profile, the estimated cone radius was found to be 10.6  $\pm$  0.6  $\mu\text{m}$  (n=58).

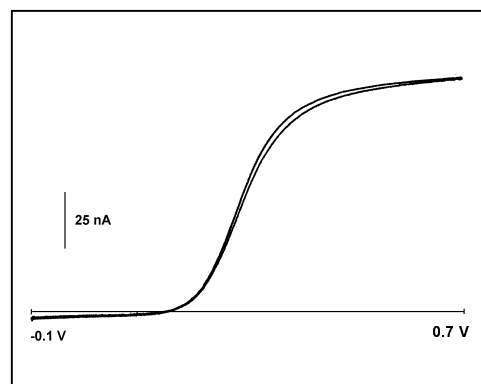
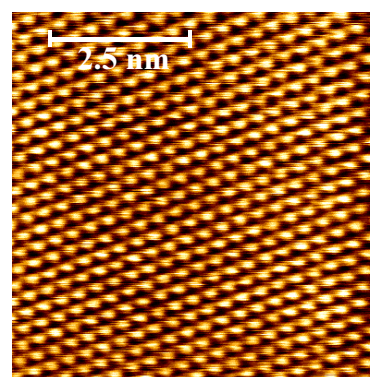


Fig. 2 : Cyclic voltammogram of a Pt-tip electrode in a 100 mM ferroCN / 1M KCl, scan rate : 100  $\text{mV}\cdot\text{s}^{-1}$



$\Delta z = 0.17 \text{ nm}$

Fig. 3 : STM of HOPG in air with a Pt-tip

The evaluation of the imaging quality of the tips is an ongoing process. The initial STM test experiments on HOPG in air (fig. 3) revealed a quite good imaging quality of these tips. Also, a SECM topographical and “chemical” images of a 25  $\mu\text{m}$  band electrode array could be obtained [6].

### References :

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