

# A Pencil Probe System for Electrochemical Analysis and Modification in Nanometer Dimension

SNF Researchers: R. Fasching,\* Y. Tao, K. Hammerick

Principal Investigator: F. Prinz, Departments of Mechanical Engineering and Materials Science, Stanford University

## Abstract

A pencil-shaped electrochemical transducer system for analysis or surface modification in nanometer dimension has been developed (Fig.1). High aspect ratio tip structures are shaped combining isotropic and anisotropic deep reactive etch processes to form the body of the transducer. In this way, tips with an aspect ratio higher than 20 and a tip radius of smaller than 50 nm can be achieved. Subsequently, a three-layer system (an isolation layer: silicon nitride, a metal layer: platinum or gold and an isolation layer: silicon nitride) was deposited on the tip structure. Planarization of this structure in combination with a back etch process enables a precise exposure of the buried metal layer down to an electrode dimension of 200 nm on the tip.

Electrochemical and impedance spectroscopic characterization showed full electrochemical functionality of the transducer system. Due to the high aspect ratio topography, this probe is particularly suited for Scanning Electrochemical Microscope (SECM) - methodologies.

Furthermore this technology promises a feasible production possibility for both probe-arrays and probes on cantilevers, which we have been exploring recently.

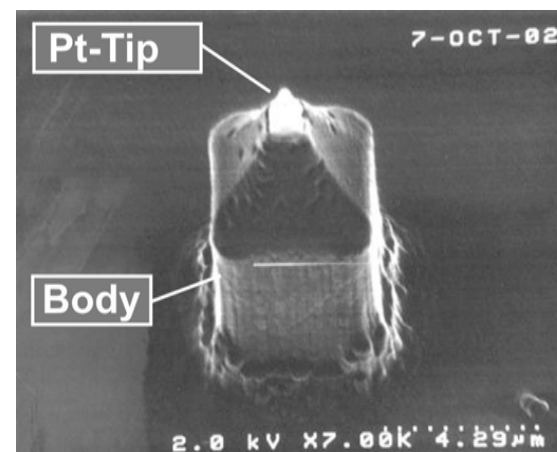


Fig.1: SEM picture of a pencil probe (height: 17  $\mu\text{m}$ , width: 4  $\mu\text{m}$ , electrode area: 0.7  $\mu\text{m}^2$ )