

Nanostructured Metallic Surfaces for Biological and Biomedical Applications

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Abstract Noble metallic electrodes, especially, gold, solid gold-amalgam, silver or palladium are very suitable for biological applications in the field of fragment biological samples detection such as microRNA or proteins as disease markers [1, 2]. Various nanostructured surfaces based on metallic nanopillars, nanorods or nanowires are useful in microdevices.

The present work deals with the fabrication of nanostructured surfaces formed by array of nanorods (see Fig 1). For the fabrication of nanostructured surfaces, the template based method is employed. Namely the nanoporous anodic aluminum oxide (AAO) has been used as a template for the growth of various functional nanomaterials and as a scaffold for nanodevices. Also, we present a new electrochemical approach of pore opening from AAO bottom. Selective perforation of an oxide barrier on AAO bottom using re-anodization technique and oxide ingrowth of metal oxides were developed. The skip phasing of oxide barrier wet etching is the significant advantage in comparison to other techniques, since it does not suffer from size increase of the naturally grown pore. Obtained nanowires have various lengths ranging from 50 nm up to 10 μm and diameter in the range of 10–300 nm.

In this case, the surface characterization and following protein detection was performed by EIS (electrochemical impedance spectroscopy). The EIS has showed the high dependence between the rate of nanomachining and active electrochemical surface area, which is directly related to the level of sensitivity [3].

References

- [1] Juskova, P., et al., *Anal. Chem.* **827** (2010): p. 2690-2695.
- [2] Cernei, N., et al., *Int. J. Electrochem. Sci.* **75** (2012): p. 4286-4301.
- [3] Hrdy, R., et al., *Int. J. Electrochem. Sci.* **84** (2013): p. 4384-4396.

Figures

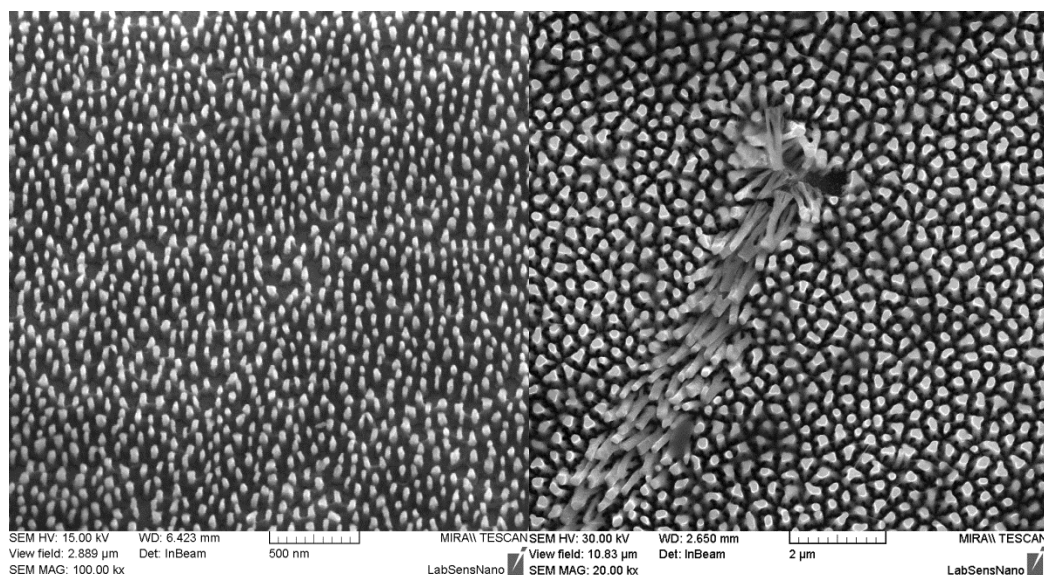


Fig. 1. SEM images of microelectrodes with gold nanostructured surface (left) and an array of palladium nanopillars prepared for the hydrogen detection (right)