Poster

# INTERDIGITATED NANOELECTRODES FOR NANOPARTICLE DETECTION

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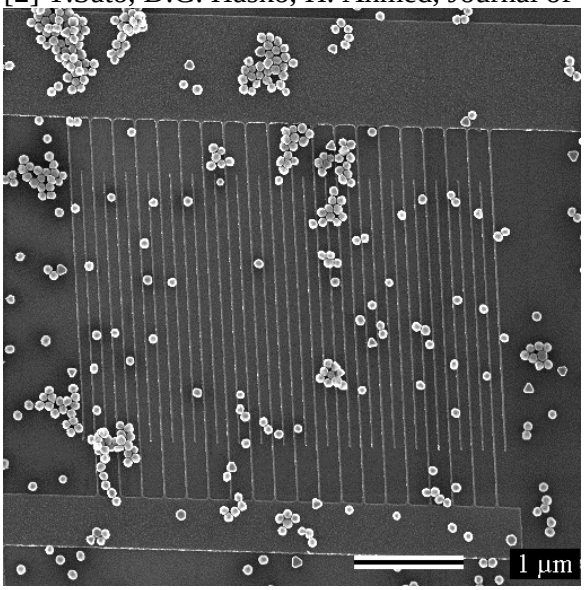
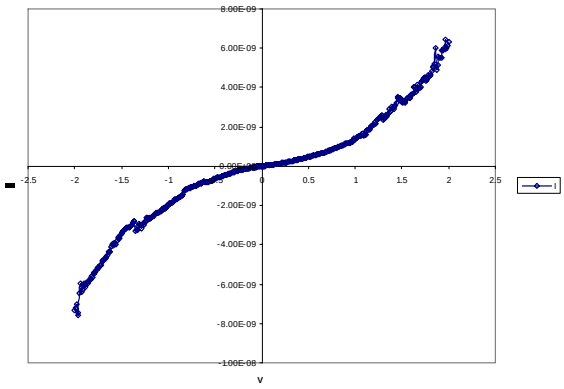
Interdigitated nanoelectrodes have a very large panel of applications running from organic devices (organic FETs) to biomolecule detection devices [1], or nano-electrochemistry. These nanoscale interdigitated electrodes turned out to be very efficient for electrically addressing small nano-objects or for designing short conduction channels while conserving sufficient current density. In this paper we present our fabrication technique involving high resolution electron beam lithography. Specific exposure strategies and development conditions have been optimized for fabrication with a very high success rate, electrodes of 20 nm width and 100 nm period. These nanoelectrodes are used as a detection device capable to sense the adsorption of gold nanoparticles (NPs).

Negatively charged Au NPs are deposited on the surface of the electrodes by incubation in a PH controlled aqueous solution. Electrostatic grafting is performed due to exposure of the nanodevice surface to an 3- aminopropyltrimethoxysilane (APTMS) solution before NP incubation, that provides positive charges on the surface [2]. We found interestingly that the nature of the metal forming the nanoelectrodes is crucial for the adsorption process. Pure gold nanoelectrodes repel the NPs while Au/Pd or Ni nanoelectrodes exhibit adhesion properties. We present I(V) characteristics that demonstrate the possibility to detect a few number gold NPs as soon as a single NP is able to bridge the gap between two adjacent electrodes. We discuss the origin of the conducting mechanism and the quantification of the current signal. We demonstrate that due to unavoidable tunnel junctions between the nanoelectrodes and the NPs, the quantification of the number of adsorbed NPs on the surface through current measurement is uneasy due to tunnel resistance fluctuations. However, some measurements performed in solution while the NPs incubate on the device show that single NP detection is perhaps possible due to the reproducible observation of current jumps at a fixed bias.

**References:**

[1] L.Malaquin, C.Vieu, M.Geneviève, F.Carcenac, Y.Tauran, V.Leberre, E.Trévisiol, Applied Nanoscience 2004.
[2] T.Sato, D.G. Hasko, H. Ahmed, Journal of Vacuum Science and Technology B15, 45 (1997)




SEM image of interdigitated nanoelectrodes (20 nm width, 120 nm pitch) after 15 minutes of incubation of a solution containing 80 nm Au nanoparticles and RT I(V) characteristics.