ELECTROCHEMICAL FABRICATION AND CHARACTERIZATION OF GOLD NANOWIRES.

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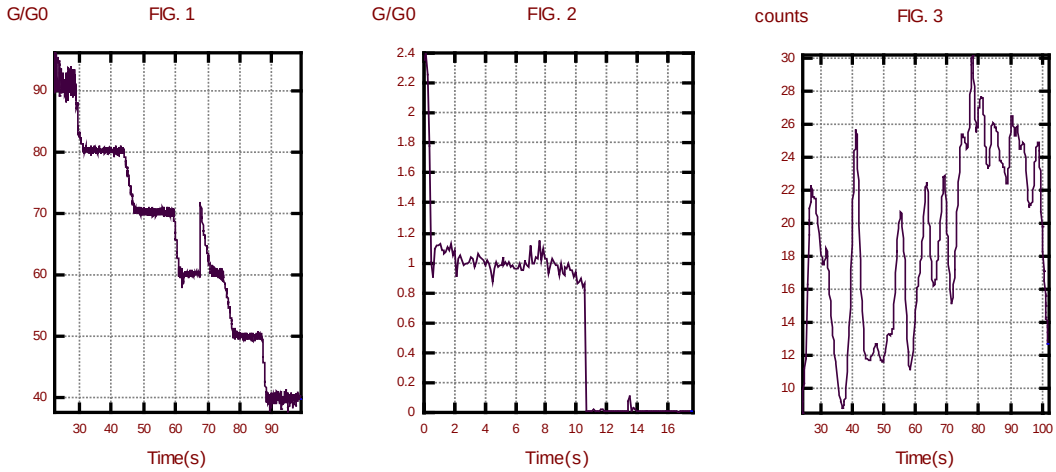
Electrochemical methods have recently become an interesting tool for fabricating and characterizing nanostructures at room temperature such as nanocontacts or nanowires [1,2]. The controllable fabrication of nanogaps and nanocontacts is crucial in the development of nanoscale electronics devices [3]. Simplicity, low cost and reversibility are some of the advantages of this technique that allows to work at nanoscale without requiring sophisticated instrumentation.

In our experimental setup, we measure the conductance across a nanocontact fabricated either by disolving a macroscopic gold wire or depositing it in between two separated gold electrodes. The conductance is directly related with the radious of the contact. We have achieved a high level of control on the electrochemical fabrication of very small contacts (just a few atoms) in gold [fig. 1]. Also, it is possible to reach stable one-atom contacts, whose conductance is just the quantum unit of conductance G_0 [fig. 2].

We have observed “plateaus” in conductance during the electrochemical growth and etching of gold nanowires. Histograms reveal a certain periodicity of these plateaus [fig. 3], indicating the presence of some stable diameters. The analysis of the data exhibits a behaviour that is similar to the refered in previous works about shell structure in gold, using other tecniques like STM [4] or Mechanically Controlled Break Junction [5].

Our aim is to get the maximum control over the electrochemical fabrication process at nanoscale. Making of electrochemistry a reproducible technique to prepare nanocontacts will open several possibilities that are not feasible with other instruments. Some examples could be to deposite multilayers with atomic precision, to produce molecular junctions or to change the nanocontacts properties by adding reactives to the solution. It involves, also, the possibility of reproducing experiments that today are made by more expensive, complicated or irreversible methods.



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