

# Formation of Stable Metallic Nanocontacts by mechanical annealing

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Metallic nanocontacts can be fabricated using a Scanning Tunneling Microscope or related techniques. In these experiments the evolution of the lateral size of the nanocontact can be followed, down to the atomic contact, by measuring its electrical conductance. Such evolution, shown as a trace of conductance, will normally differ for each experimental realization and therefore conductance histograms are normally used to identify preferential configurations.

However it can be shown that occasionally there are some atomic configurations that can be repeated during consecutive cycles of mechanical deformation of the contacts. Here we report experiments for gold nanocontacts where the same trace of conductance can be obtained for hundreds of cycles of formation and rupture of the contact. We have studied the process leading to such repetitiveness of the traces and found that this is obtained when limiting the indentation depth between the two surfaces to a conductance value of approximately 5 or 6  $G_0$ . Using molecular dynamics simulations we have obtained the same behavior and observed how, after repeated indentations, the two metallic contacts are shaped into a stable configuration by mechanical annealing.

This confirms and explains the fact that repeated indentation of a tip into a metallic substrate can be used as a method to sharpen or clean STM tips, but only when such indentation does not exceed a limit which here is characterized for the case of gold.

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## Figures

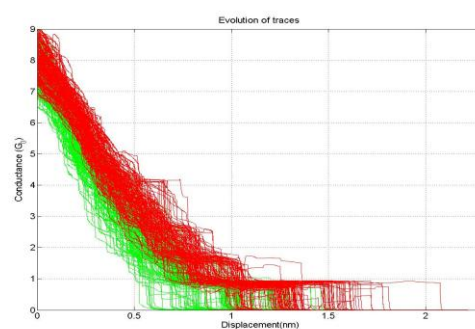
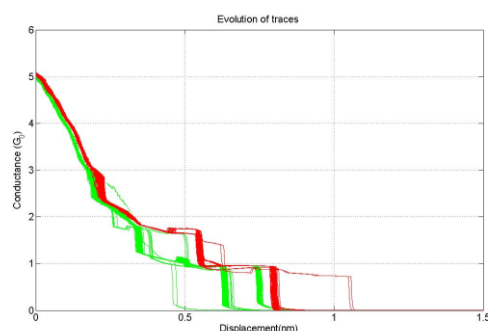


Figure 1. Trace's conductance of contact stable. Figure 2. Trace of conductance contact no stable.

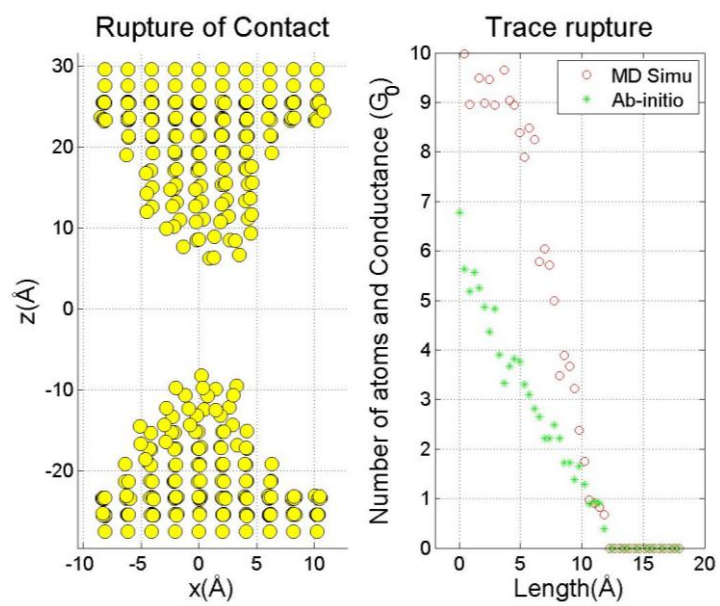


Figure 3. Geometry, Ab-initio calculations and Molecular Dynamic during the process formation of stable metallic nanocontact.