

Fabrication of Metallic Nanogaps Using in-situ Controlled Thermal Evaporation

A. G. Demirkol and **I. I. Kaya**

Faculty of Engineering and Natural Sciences, Sabanci University, Istanbul 34956, Turkey

There has recently been a great effort to fabricate nanogaps, two metallic electrodes with a few-nanometer or a sub-nanometer gap, to study the electronic properties of nanoscale structures like single molecules and nanocrystals. Although various nanogap fabrication techniques have been already been developed they either suffer from low yield, uncontrolled or bulky^{1,2}. Here, we report a new fabrication technique based on the controlled-shrinkage of a wide gap down to a vacuum tunneling gap with predetermined conductance.

The devices were fabricated on a Si wafer with a SiO₂ and a Si₃N₄ layers on top it. The metallic tips were defined using electron-beam lithography. Then the metallic tips were exposed to thermally evaporated Au atoms and the gap size between the electrodes is reduced while the conductance between the gaps was continuously monitored. Evaporation is halted as soon as the desired conductance is achieved. The sizes of the gaps are typically smaller than few nanometers. After the tunneling gap was fabricated, its current-voltage characteristics were measured. The fitting of the experimental data to the well-known Simmons model to determine and the gap size

¹Park, H. et.al., Appl. Phys. Lett. **75**, 301 (1999)

²Tian, J. et. al., Nanotechnology **21**, 274012 (2010)