Formation of nanometer-size liquid bridges in non-contact AFM

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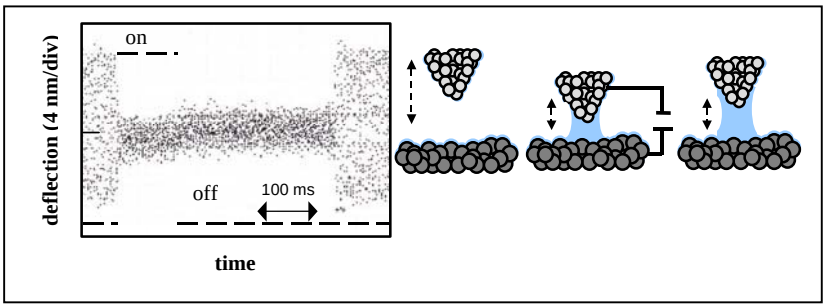
We present a method to form and manipulate the properties of nanometer-size liquid bridges with a dynamic force microscope. The method is based on the application of an electrical field between a sharp tip and a flat conducting surface. The properties of the bridges are shown to be the result of an interplay among the field-induced polarization of the water layer adsorbed on the surface, the surface energy, and the water condensation from humid air[1-2]. Liquid bridges from water, ethanol and non-polar organic solvents have been formed with vertical and lateral sizes 5 and 10 nm respectively[3].

Those bridges can be used to confine chemical reactions, in particular the oxidation of the sample surface. In this way a versatile and flexible nanolithography can be developed. The liquid bridge provides the ionic species and the spatial confinement to oxidize Si(100) surfaces. The small number of active ionic species within the bridge, a few attomoles allows a very precise control of the lateral and vertical size of the oxide.

Several applications in the fabrication of nanometer-scale devices will be presented, such as: (i) arrays of 5000 dots with a periodicity of 40 nm and an average width of 10 nm, (ii) masks for template growth of organic molecules[4] and silicon (iii) silicon wires.



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