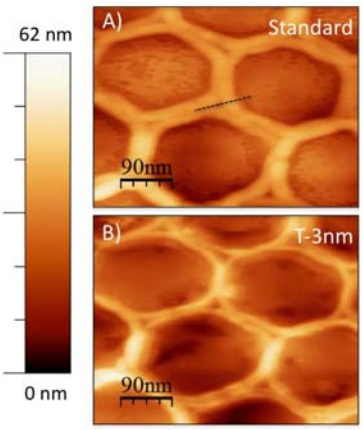
Modification and functionalization of AFM tips

CSIC has developed a method to modify the aspect ratio of atomic force microscopes (AFM) tips, while at the same time changing their chemical composition, by adding nanoparticles of controlled size (with a diameter of approximately 2 nm) to the tip surface. This enables attaining better resolution, and provides a means for functionalizing the tips—a useful feature to characterize materials by some physical or chemical property (as e.g. piezoelectricity or conductivity). Partners are sought to collaborate in the development of applications, and to exploit the existing know-how through a patent license agreement.

Taking resolution to a new limit

The geometry of AFM tips used to perform the measurements determines the resolution of an atomic force microscope. One of the key parameters is their aspect ratio, since it determines the size of the surface characteristics which can be ultimately resolved by the microscope. Alternatively, the performance of AFM can be enhanced by functionalization of the tips.

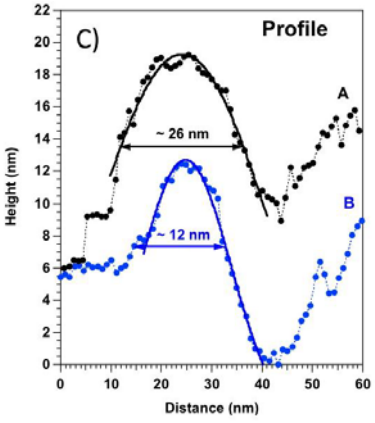
The technology patented by CSIC overcomes the question of whether to increase the aspect ratio of commercials tip or to functionalize them by achieving both goals simultaneously.



AFM + ICS = better resolution + functionalization

Nanoparticles of different materials—depending on the application—and controlled size are added on the surface of the tips with an ion cluster source (ICS), guaranteeing the chemical purity of molecular aggregates. The nanoparticles added act as the ultimate probe in AFM imaging.

The AFM images on the right show a system of ordered Ce-Zr macropores explored with a standard commercial tip (A) and with a tip covered by nanoparticles (B). The better resolution of functionalized tips can be clearly appreciated. The corresponding profiles showing the resolution enhancement can be seen below (C).



Main applications and advantages

- Functionalization of tips with a simultaneous enhancement of its aspect ratio.
- It is possible to add nanoparticles of any kind of material to the tips, provided it can be sputtered, to explore different physical properties.
- Chemical purity of the nanoparticles/molecular aggregates is provided by the ion cluster source.
- The method is easy to implement at an industrial scale, since sputtering procesess in vacuum chambers are already widespread.

Patent Status

Spanish patent application filed

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