

Research Journal of
Nanoscience
and Nanotechnology

Manufacturing 'Made to Measure' Atomic-Scale Electrodes

Scientists in Donostia-San Sebastian and the University of Kiel (Germany) have shown that it is possible to determine and control the number of atoms in contact between a molecule and a metal electrode of copper, at the same time as the electric current passing through the union being recorded.

Results were published in the journal *Nature Nanotechnology*. One of the key problems in nanotechnology is the formation of electrical contacts at an atomic scale. This demands the detailed characterization of the current flowing through extremely small circuits so small that their components can be individual atoms or molecules. It is precisely this miniature nature of the system, of typically nanometric dimensions (1 metro = a thousand million nanometers), where the difficulty of this yet unresolved problem arises. In particular, in unions formed by a single molecule, it has been shown that the number of individual atoms making up the contact and their positions are crucial when determining the electric current that is flowing. To date, there has been no experiment where it has been possible to control these parameters with sufficient precision.

In the research published in the *Nature Nanotechnology* journal, however, these scientists have revealed and explained the changes that the electric current flowing through a molecular union (metal/molecule/metal) undergoes, depending on the area of contact uniting the molecule to the metallic electrodes. Basically, changing the number of atoms in contact with the molecule, one by one, it goes from a low state (bad contact) to another, higher one (good contact) of conduction. With bad contact the current is limited by the area of contact, while with good contact the current is limited by the intrinsic properties of the molecule.

Taking part in this collaboration project were scientists from the Donostia International Physics Center (DIPC), from the Physics of Materials Centre at the CSIC-University of the Basque Country (UPV/EHU) Mixed Centre and from the Department of the Physics of Materials at the Chemistry Faculty of the UPV/EHU.