Abstract

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Formation and transport mechanisms in individual and self-assembled networks of molecular junctions

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Nanometer scale structures embedding molecular compounds represent a versatile test-bed to investigate non-equilibrium quantum transport phenomena. We follow two experimental routes to characterize and control electronic transport in molecular junctions.

Using mechanically controllable break junctions, we investigate the interplay between local spatial ordering and electronic structure to better understand the electrical transport in molecular junctions. Spectroscopic techniques help develop a deeper insight in structure-transport correlation at the individual junction level. In this perspective, I will present recent conductance fluctuations measurements [1] as well as force [2] and IV spectroscopy characterization of molecular junctions.

Arrays of metal nanoparticles interlinked by an organic matrix have attracted a lot of interest due to their diverse electronic and optoelectronic properties. We have recently shown that nanoparticle arrays form a useful architecture to build networks of molecular junctions [3]. Here, the nanoparticles act as electronic contacts to the molecules and a molecular functionality can be used to induce an overall functionality at the array scale. Using this approach, we have built nanoparticles arrays exhibiting for instance redox [4] and optical [5] switching behaviors. The latter is made possible thanks to the

excitation of surface plasmons in the nanoparticles. In this particular configuration, the molecules can easily be accessed by optical means. Nanoparticle arrays thus represent an interesting architecture opening possibilities for the development of novel molecular scale electronic and optoelectronic devices. Their possible implementation as an information storage platform or even as computing networks thanks to a defect-tolerant architecture is currently under investigation [6].

References

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