

Stiffness and Electronic Properties of a Single Molecular Wire

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Recent Developments in Atomic Force Microscopy made it possible to probe not only electronic properties of single molecules and atoms on conducting surfaces but also acquiring information about forces in the pN regime simultaneously. Determination of the charged state of single metal atoms [1] or resolving the chemical structure of a molecule [2] are just some of the possibilities, opening new dimensions of scanning probe spectroscopy.

In our experiments we create molecular nanocontacts to get insight into the correlation between conductance and molecular conformation. We utilize a tuning fork based LT STM/AFM with the qPlus design operated at 7K to perform single molecule force spectroscopy and conductance measurement simultaneously. With our STM tip we contact a functionalized polyphenyl molecule in one side and lift it up from the surface, while the other side remains attached to the substrate [3]. During lift up we observe characteristic features in the molecular conductance and find these correlated with plastic changes of the molecular junction. In agreement with DFT simulations we identify the creation of chemical bonds as their origin and can draw a detailed picture of a single molecular wire lifting process.

References

- [1] Gross, *et al.*, Science **324**, 1428 (2009)
- [2] Gross, *et al.*, Science **325**, 1110 (2009)
- [3] F. Pump, *et al.*, Appl. Phys. A **93**, 335 (2008)