Light-Induced Switching of Tunable Single-Molecule Junctions

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Abstract

Molecular electronics aims at scaling down electronics to a regime of 1-2 nm for single components. In order to design electrical circuits which base on the properties of single molecules, reliable contacts to single organic molecules have to be built and the properties of those junctions need to be characterized. We have demonstrated that the mechanically controllable break junction (MCBJ) technique can be successfully used to determine the properties of electronic transport through single organic molecules and that the participating molecular energy levels and the metal-molecule coupling can be characterized using this technique[1]. Further developments are based on the use of more complex molecules, which can, for example, be used as single molecule switches[2,3]. We present the first demonstration of a single molecule junction, in which the molecule is switched *in situ* from the non-conducting "off"-state to the conducting "on"-state. The molecule is attached to gold electrodes via thiol linkers and can be switched by irradiation with UV-light (see figure). The conductance of the single molecule junctions is determined by recording the resistance during stretching the junction. Additionally, current voltage characteristics are recorded once a single-molecule contact has been formed. By comparing these curves with the single level model, we can extract the energy of the molecular level and its level broadening. This shows clearly that a single molecule is switched *in situ* to the on-state. The conductance of the on-state can be tuned by varying the molecular structure. These are important steps in the development of functional molecular junctions.

References

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Figures