Electrical conduction through molecules: Influence of endgroups and sidegroups

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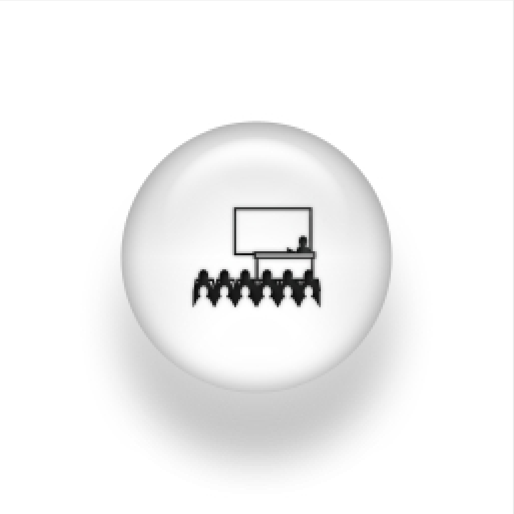

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Molecular electronics aims for scaling down electronics to its ultimate limits by choosing single molecules as the building blocks of active devices. The advantages of this approach are the high reproducibility of molecular synthesis on the nanometer scale, the ability of molecules to form large structures by self-assembly and the huge versatility of molecular complexes. On the other hand, conventional contacting techniques cannot form contacts on the single molecule scale and imaging techniques nowadays cannot provide a detailed image of such junctions. Therefore the fabrication has to rely on some degree of self-organization of the constituents and the proof that a molecule has been contacted successfully can be only given by indirect methods, for example by measuring the current transport through the junctions.

In this talk the role of the molecular functionalities which link the molecule to the metallic electrodes will be investigated. We studied a series of simple molecules, equipped with varying linking groups, using the mechanically controlled break junction technique and compared the conduction properties.

In addition, a simple toy molecule is presented in order to understand the molecular transport and compared to the measured data. A more complex molecule showing a pronounced switching effect upon changes of the applied bias voltage is shown to demonstrate the possibility of functional molecular electronic building blocks. DNA molecules are ideal candidates for self-organizing electrical circuits. Our measurements on G-quadruplex oligonucleotides reveal reproducible conduction behavior which sustains stretching of the molecular junctions.