TECHNISCHE UNIVERSITÄT CHEMNITZ

Institut für Physik
Physikalisches Kolloquium

Mittwoch, 03.02.2016, um **16:00 Uhr**

Ort: Reichenhainer Str. 90;
Zentrales Hörsaal- und Seminargebäude, Raum 2/N013

Dr. Dirk Mayer

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Charge transport through model molecules investigated by break junctions on the level of individual molecules

Theoretical and experimental investigations of charge transport through (bio) molecules have attracted considerable attention driven by the interest in fundamental aspects of charge transport and the vision of future applications in molecular electronics and of biosensors. We are addressing mechanistic questions of the relation between intra and intermolecular electron transport in model molecules, which have analogous in nature. Therefore, we established a mechanically controllable break junction setup (MCBJ) where the molecules of interest are anchored between two or three nanoelectrodes.[1] We investigated alkanedithiols with weak van der Waals type intermolecular interactions. Based on I/V characteristics and transition voltage spectroscopy we could demonstrate that alkanes can be considered as individual transport channels and intermolecular electron transport is of minor importance.[2]

This changes if functional units are introduced into the molecules that can bridge two molecular units together via metal ions. We have used aminooligocarboxylic acids, a general sequestering agent, to build molecular junctions bridged by different metal ions. A statistical analysis of the recorded conductance traces revealed that the complex conductance depends strongly on the type of coupling ion.[3] The conductance was found to be reciprocal dependent on the respective complex stability.

Since metal complexes are mainly hold together by electrostatic interactions we also compared the conductivity of electrostatically and covalently bridged metal – molecule – metal systems. The obtained single molecule conductance of the electrostatically linked junctions was one order of magnitude smaller than the conductance of covalently linked systems, which indicates that the intermolecular electron transport through electrostatic interfaces has lower efficiency compared to intramolecular electron transport.[4]

Finally, I will present recent technological approaches from our group to change from high resistant single molecule junctions to 2D ensemble contacts. Therefore, micro- and nanoscale crossbar arrays are assembled by means of a noninvasive transfer printing process, which does not impair the integrity of molecular films.[5] The functionality of these 2D junctions has been tested by integrating films of conductive polymers and organic semiconductors in between bottom and top electrode.

[1] D. Xiang, et al. Nano Letters *13* (2013) 2809.
[2] D. Xiang, et al. Chem. Commun. *47* (2011) 4760.
[3] D. Xiang, et al. Chem. Eur. J. *17* (2011) 13166.
[4] Z. Yi, et al. Chem. Commun. *46* (2010) 8014.
[5] N. Sanetra et al. Adv. Funct. Mater. *22* (2012) 1129.

Alle Zuhörer sind ab 15:45 zum Kaffee vor dem Hörsaal eingeladen.

Informationen zum Vortrag erteilt:
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