

## Charge-Carrier Transport Measurements through Single Molecules



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## CHARGE-CARRIER TRANSPORT MEASUREMENTS THROUGH SINGLE MOLECULES



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Cuvillier Verlag Okt 2007, 2007. Taschenbuch. Book Condition: Neu. 210x147x14 mm. Neuware - The goal of this thesis was to establish and to characterize single-molecule junctions by means of the mechanically controllable break-junction (MCBJ) technique. Using this method, an electrode pair with atomic-sized tips can be created. These tips are located exactly opposite to each other and their distance can be adjusted with picometer accuracy. This technique was developed by Moreland et al. in 1985 and further improved by Muller et al. in the subsequent years to study quantum phenomena in superconductors. Mechanically controllable break-junctions are distinguished by an excellent stability of the two electrodes against external vibrations. The stability is achieved by a purely mechanical transaction in a three-point bending mechanism with a very low transmission ratio between the pushing-rod travel distance, and the electrode separation resulting there from (ratio of approximately  $1 \times 10^{-5}$ ). This lateral stability combined with a sub-atomic spatial electrode positioning accuracy allows single molecules to be contacted. In the framework of this thesis, an ultra-high vacuum system equipped with a MCBJ bending mechanism was designed, fabricated, characterized, and continuously improved. This experimental system can be used to establish a contact with a single molecule and to perform temperature-dependent investigations of its charge-carrier transport properties. The thermal coupling between the cryostat and the sample holder was improved in several ways to achieve a temperature range of 8 to 300 K. The bending mechanism of the break-junction was also modified considerably. For instance, additional supporting bolts and a proper head opposite to the pushing-rod ensure the back bending of the substrate should the bending force might have exceeded the elastic range of the metal (bending radii larger than 18 mm). As a result, the junction can be opened and closed several hundred times without any sign...



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