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TÉMA

Quantum Point Contact Microscopy

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Scanning tunneling microscopy (STM) relies on probing a conductive surface in the evanescent tail of electronic states. By decreasing the tip-sample distance the sensitivity to chemical interactions can be enhanced as has been demonstrated in non-contact atomic force microscopy (AFM), where the oscillating tip comes for short periods of time within the range of chemical interactions. Here, I introduce Quantum Point Contact Microscopy (QPCM) as a novel imaging mode of STM, where instead of measuring a current through a tunneling junction, a transport current through a quantum point contact formed by a single atom between the STM tip and the surface is recorded. The single atom contact is scanned across the surface yielding a spatial map of conductance. QPCM is demonstrated for the (111)-surfaces of copper, silver, platinum and gold, where the atomic periodicity of the surface is routinely resolved. The alternating local atomic stacking due to the surface reconstruction is observed on Au(111) in real space in QPCM conductance maps. The perspectives for a detailed characterization of the surface chemical composition are demonstrated for an iron-platinum surface alloy. We observe local variations of the transport current due to changes in the chemical environment of the point contact. On Ag(111), we study the influence of coherent scattering at defects on quantum transport by spatially mapping the conductance fluctuations. Our measurements allow for a microscopic view of the influence of scattering on quantum transport.

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