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Communication

Quantum interference effect in the charge transport through single-molecule benzene dithiol junction at room temperature: An experimental investigation

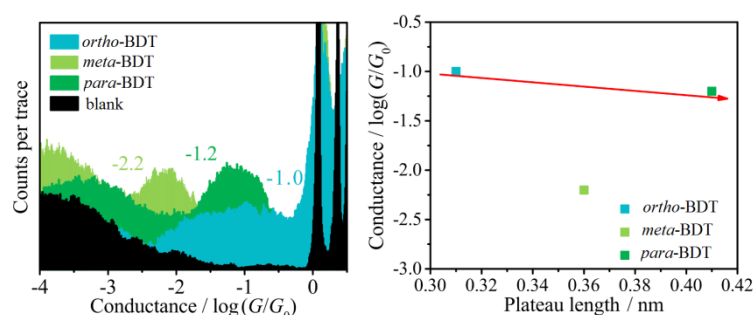
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Graphical Abstract



The electrical characterization on single-molecule benzene dithiols with different connectivities showed that the *meta*-BDT has the lowest conductance, which suggested that there is destructive quantum interference effect in the charge transport through single-phenyl molecules.

ABSTRACT

The quantum interference effect in the charge transport through single-phenyl molecules received intensive interests from theory but remained as an experimental challenge. In this paper, we investigated the charge transport through single-molecule benzene dithiol (BDT) junction with different connectivities using mechanically controllable break junction (MCBJ) technique. By further improving the mechanical stability and the electronic measuring component of the MCBJ set-up, we obtained the conductance histograms of BDT molecules (BDTs) from the statistical analysis of conductance-distance traces without data selection. By tuning the connectivity, the conductance of BDTs is determined to be $10^{-1.2} G_0$, $10^{-2.2} G_0$ and $10^{-1.0} G_0$ for para, meta, and ortho connectivity, following the trend that ortho-BDT > para-BDT > meta-BDT. Furthermore, the displacements of the junctions followed the trend that para > meta > ortho, suggesting the charge transport through the molecules via the gold-thiol bond. The different trends between conductance and displacement for different connectivities suggests the presence of destructive quantum interference effect on meta-BDT, which provides the experimental evidence for the quantum interference effect through single-phenyl molecular junctions.

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