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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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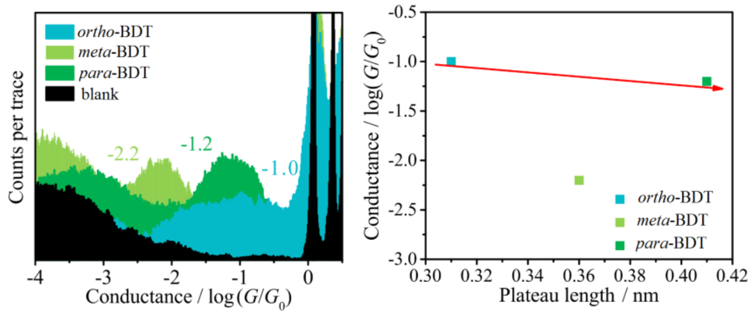
Graphical Abstract



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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