Asymmetry as a key factor for increasing the functionality of a molecular logic gate

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Design and fabrication of nanoscale functional electronic units remains a main task of molecular electronics. Recently, it was shown, that by manipulating single gold atoms under symmetric Y-shaped molecule, one could demonstrate the functionality of a NOR logic gate.[1] In our work, we investigate the role of asymmetry for the functionality of such a system. By applying classical gold inputs in different configurations, we can obtain various logical behavior of the system as an output, measured by the shifts of scanning tunneling spectra. Thus, bringing the asymmetry into the molecule increases the functionality of a molecular logic gate. To fabricate a fully conjugated asymmetric Y-shaped molecule on Au(111) surface, we employ surface-assisted cyclodehydrogenation.

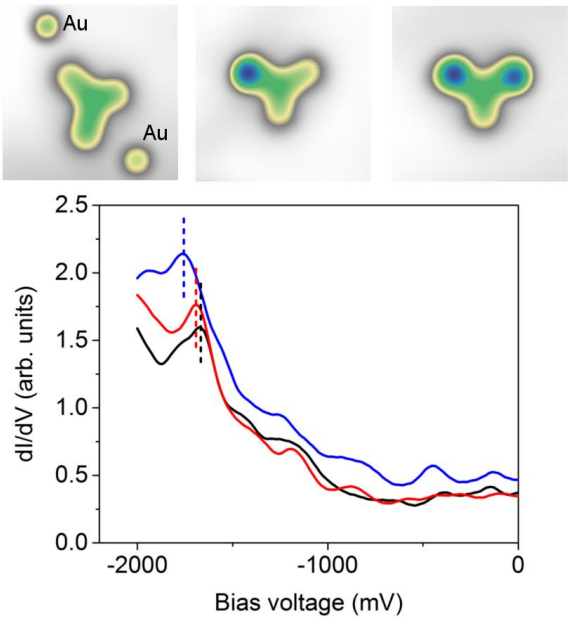

Figure 1. Demonstration of NAND molecular logic gate by successively bringing Au atoms under the longer branches of an asymmetric Y-shaped molecule.

References

[1] Soe W.-H. et al., ACS Nano, 5/2 (2011) 1436-1440.