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Conductance of Organometallic Single Molecule Junctions---Studied by Scanning Tunneling Microscope-Break Junction (STM-bj)

Xinlei Yao,[1,*] Xiaonan Sun,[1] Frédéric Lafolet,[1] Jean-Christophe Lacroix [1]
[1] *Univ. Paris Diderot, Sorbonne Paris Cité, ITODYS, CNRS UMR 7086-15, rue Jean-Antoine de Baïf, 75205 Paris, France*
* Email : yxlei676@gmail.com

Organometallic complexes, with interesting electrochemical and photophysical properties, are promising molecules incorporated in molecular junctions for nanoscale electronic devices. The study of their conductivity and charge transport mechanism is of fundamental importance in such field. Scanning tunneling microscope, as one of the best tools to build single molecule junctions, has been widely developed for measuring the conductance of various kinds of molecules. In this work, we use the technique of Scanning tunneling microscope break junction (STM-bj) to form the single molecule junctions of organometallic complexes between Au electrodes and successfully get the conductance (G) value. By varying the length and type of organometallic molecules, we are able to get the attenuation factor β to quantitatively characterize the conductivity. For $Co(tpyr)_2$ single molecule junction, the conductance is measured to be 2.8×10^{-3}G0 and β is as low as 0.19 nm^{-1} with the increase of molecular length up to 10 nm, in which the electron transfer is assumed to follow the long-range resonance tunneling. When the metal center is changed to Ruthenium, the conductance of single molecule junction is 5.8×10^{-4}G0, which is about one magnitude lower compared with Cobalt complex. Moreover, the β value of Ruthenium complex molecular junction varies in different range of molecular length: below and above 2.8 nm, β is estimated to be 1.5 nm^{-1} and 0.45 nm^{-1} respectively. This phenomenon shows a mechanism transition of electron transfer in Ruthenium complex, which is first seen by STM-bj and is going to be investigated for deep understanding of electron transfer in single molecule junctions. This transition is also observed on large area molecular junction, thus it is interesting to compare these two techniques for building molecular junctions.

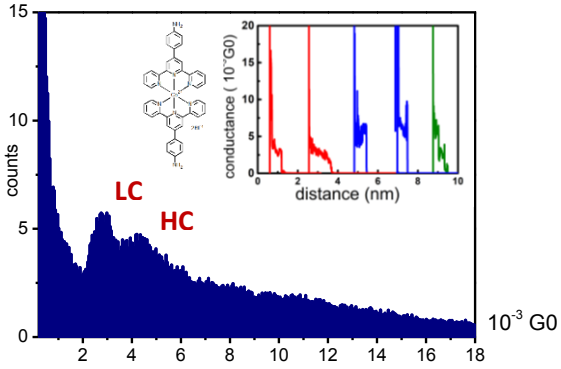

Figure 1 –Conductance curves and histogram for $Co(tpyr)_2$ single molecule junction

Référens

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[2] N. Van Quyen, M. Pascal, F. Denis, D.R. Maria Luisa, L. Frédéric, B. Sebastien, L. Philippe, L. Jean-Christophe, *J. Am. Chem. Soc.* **140** (2018) 10131-10134