Electrochemical Control of Electron Tunnelling to a Single Gold Nanoparticle: A Scanning Tunnelling Spectroscopy Study

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Gold nano-particles have been attached on Au(111) substrates through self assembled dithiol molecules each incorporating a redox active bipyridinium (viologen) moiety located at its centre. The redox active viologen group can be electrochemically "switched" between its V^{2+} and $V^{\bullet+}$ state. Scanning tunnelling spectroscopy has been used to monitor electron tunnelling from the substrate to the STM tip through a single nanoparticle, as illustrated in the figure. Only in its $V^{\bullet+}$ state does the redox active group support transparency of the tunnelling barrier between the gold surface and the nanoparticle. This ability to alter the barrier transparency through redox switching provides new possibilities for future nanoscopic electronic devices.[1]

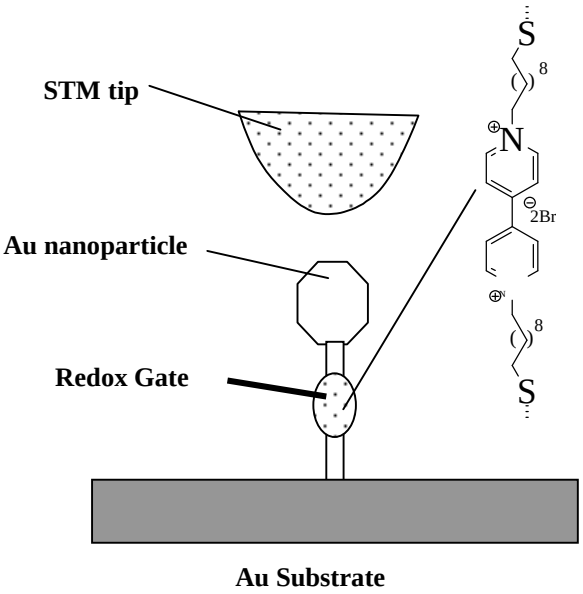

Figure 1 Schematic representation of the nanoscopic arrangement assembled. The STM tip was used to establish electronic communication with the external world. Electrons can be injected in the redox gate by applying a suitable potential with respect to the substrate. The tip-to-substrate potential is controlled independently.

1. Gittins D.I., Bethell D., Schiffrin D.J. and Nichols R.J., Nature 408, 67-69, 2000.

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