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Electrical Conductance and Reversible Conductance Switching in Molecular Junctions[1]

BERT DE BOER, Molecular Electronics, Zernike Institute for Advanced Materials, University of Groningen, The Netherlands

A technology is demonstrated to fabricate reliable molecular metal-molecule-metal junctions with unprecedented device diameters up to 100 μm. The yield of these molecular junctions is close to unity. Stability investigations have shown a shelf life of years and no deterioration upon cycling. Key ingredients are the use of a conducting polymer layer (PEDOT:PSS) sandwiched between the self-assembled monolayer (SAM) and the top electrode to prevent electrical shorts, and processing in lithographically defined vertical interconnects (vias) to prevent both parasitic currents and interaction between the environment and the SAM [1–3]. Furthermore, a fully functional solid-state molecular electronic switch is manufactured by conventional processing techniques. The molecular switch is based on a monolayer of photochromic diarylethene molecules sandwiched between two electrodes. The monolayer reversibly switches the conductance by more than one order of magnitude between the two conductance states via optical addressing. This bidirectional conductance switch operates as an electronic ON/OFF switch and as a reprogrammable data storage unit that can be optically written and electronically read [4].

[1] *Nature*, **441**, 69–72 (2006).
[2] *Proc. Natl Acad. Sci USA,* **104**, 11161-11167 (2007).
[3] *Nature Nanotechn.*, **3**, December issue (2008)
[4] *Adv. Mater.* **20**, 1467–1473.

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