Light-controlled conductance switching of a robust molecular device

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A fascinating prospect in molecular electronics is to use molecular switches in transport devices. Here, we present the results of our research on photochromically switchable diarylethenes. In solution, these molecules can be reversibly transformed from a conjugated, "on"-state to a cross-conjugated, "off"-state, by using light of the proper wave lengths ("on" to "off" : $\lambda \approx 550$ nm ; vice versa : $\lambda \approx 330$ nm). Once connected to gold, this situation may change. In fact, "first generation", diarylethene molecules attached to gold can only be switched in one direction.[1,2] We attribute this to the strong coupling of these molecules to the metal. By chemically modifying the molecule, such that it couples more weakly to the electrodes, reversible switching is indeed obtained.[3,4] We will present a novel molecular device, which consists of a network of gold nanoparticles,[5] connected by "second generation" photochromic switches. Using visible and UV light, we can control its conductance. Optical spectroscopy, revealing subsequent shifts of the Au surface plasmon, demonstrates molecular switching independently. Due to the network structure, these devices are very stable (day) at room temperature.

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