Universität Konstanz

SFB 767 Sonderseminar

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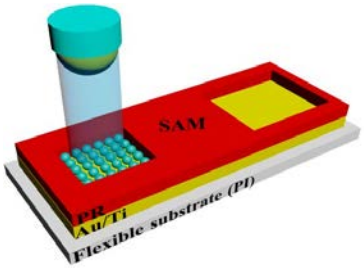
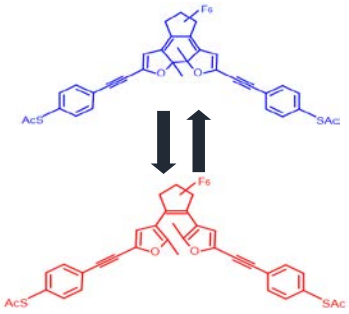
Electrical Characterization of Functional Molecular Devices on Flexible Substrates





Molecular electronics have been widely studied for many applications such as rectifier, transistor, memories, and photoswitches. However, the early days of molecular electronic devices had a serious problem of low device yield (typically less than 1 %) because of electrical shorts that might occur as a result of the top electrode's penetration through the thin molecular layers. These problems have been nearly solved by introducing an intermediated conducting polymer or graphene film between the molecular layer and the top electrode. Previously, our group has fabricated alkanethiolate molecular devices on flexible substrates and studied electrical properties under bending conditions. However, alkanethiol molecules are not suitable for real application because of the absence of potential device functionality.

In this report, we fabricated rectifying and photoswitching molecular devices ona flexible substrate and studied the electrical properties under bent substrate conditions. Ferrocene-alkanethiolate functional molecular devices showed asymmetric electrical characteristics on both rigid and flexible substrates. We observed the asymmetry ratio of ~1.6. Diarylethene molecules have two electrical conductance states; a closed (high conductance) state or an open (low conductance) state were created upon illumination with UV or visible light, respectively. These two electrical states were defined and fixed during the devices fabrication with illuminations of either UV or visible light and showed distinct current levels between the two states. However, the fabricated diarylethene molecule devices did not show reversible switching phenomena. Lastly, in order to demonstrate reversible photoswitching process, we fabricated and characterized diarylethene molecular devices by using reduced graphene oxide (rGO) as top electrode on flexible substrates. The photoswitching molecular devices with rGO top electrode clearly showed two stable electrical states with different current levels and with reversible photoswitching capability. This study has a promise towards functional molecular devices on flexible substrates.

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