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Nano electronics based on ultra-robust metal-terpyridine oligomer films and chemical or optical molecular switches

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Considerable efforts have been undertaken within the past decades to shift organic-based thin-film devices to the application level. However, a major obstacle is given by the thermal deposition of metal electrodes, which remained elusive due to the damage and the electrical shorts experienced by the fragile molecular layers. Here, we show that large area molecular junctions of outstanding electronic properties and robustness can be realized using densely packed molecular wires consisting of Fe^{II}-terpyridine complex oligomers. Surprisingly, these ultrathin oligomer-based devices are stable for over 2 years under regular current-voltage cycling, withstanding a wide range of temperatures (150-360 K) and applied voltages (3 V), so, offering a perspective to a robust platform for molecular electronics. In the second part of the talk, we demonstrate switching materials for memory applications by means of two different approaches – a chemical and a biochemical – to ultrathin molecular switching layers. In the first system, remarkable resistive switching has been obtained with tetraaniline layers and tetraaniline/PEDOT blends, switched by proton doping, to yield on/off ratios of up to 105. In the second approach, we make use of Sn-cyt c protein layers to show that they act as reversible and highly efficient photo-electrochemical switches, even upon integration into large area solid state junctions. Photocurrents are observed both in the Soret-band (□=405 nm) and in the Q-band (□=535 nm), with current on/off ratios reaching values of up to 25, so making protein photo detectors a realistic scenario.

Biography

Florian Von Wrochem is a Principal Scientist and Project Leader at Materials Science Laboratory of Sony Corporate labs (Stuttgart, Germany). He received his PhD in Physics from the University of Basel in 2007 in parallel with his R&D activities at the Sony Europe. The research in his group is addressing the development of novel organic and molecular electronic devices, e.g. memories and logic circuits for flexible electronics. These activities involve the fabrication and electrical characterization of organic opto-electronic devices at the nano and micro scale, the spectroscopic and topographic investigation of surfaces and interfaces, as well as the design and synthesis of functional materials.

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