Self-assembled monolayers as a smart strategy to arrange electro- and photo-active small organic molecules at surfaces

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Molecular self-assembly [1,2] is one of the most promising strategy for giving surface specific properties with a nanoscale control. An important field of application of self-assembled monolayers (SAMs) [2] is the so-called "molecular electronics" within which self-assembly is a very powerful way to obtain the organization at large surface scale of molecules showing particular electro-optical properties.
After the principle of SAM preparation, the motivation of developing SAMs of small organic molecules will be briefly illustrated by some examples of controlling the molecular structuration on silicon surfaces [3, 4]. How organization at the molecular scale acts on electro-optical properties of molecular chromophores will then be discussed focusing on two examples: a structure-electrical properties relationship probed by STM [5] and the SAM of a novel push-pull thiophene-based chromophore [6,7]. For the latter, dense SAM formation of such non-charged chromophore is for the first time clearly demonstrated by spectroscopy (XPS, UV-vis, IR), ellipsometry, scanning probe microscopy (STM, AFM), and electrochemical measurements. Besides, good film quality is highlighted and local I-V characteristics measured by STM and correlated to UPS (filled states) and IPES (empty states) measurements are consistent with the structure of the SAM-organized push-pull molecules standing upright at the surface [6]. This unique combination of properties makes such SAM a system of choice for the foreseen applications like in the field of PV energy conversion [8].

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