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Organic Semiconductors: devices, growth and ordered assembly[1]

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Organic semiconductors are employed in devices such as field-effect transistors (FETs), light-emitting diodes and photovoltaic cells. Besides their technological interest, these devices are model systems to study physical processes in organic semiconductors [1]. Light-emitting field effect transistors (OLEFETs) based on organic semiconducting films are a novel class of devices integrating the transistor function with the light emission [2]. I will discuss LEFETs based on oligothiophenes [3] and oligoacenes [4] [5], in particular their optoelectronic properties and the films growth physics. A unique property of organic semiconductors is the ability to form ordered assemblies at surfaces that can be studied by scanning tunneling microscopy (STM). I will discuss the adsorption and self-assembly on different facets of copper of two organic semiconductors: the linear and planar quinquethiophene [6] and the branched non-planar rubrene [7]. These studies show the ability of organic semiconductors to form fascinating self-assembled motifs and are of paramount importance to understand the early stages of growth of organic films. Organic electrochemical transistors (OECTs) are expected to play a key role in future organic electronics. OECTs are ideal candidates for biosensing applications thanks to their low driving voltage and their ability to operate in aqueous environment. A great deal of work is needed to understand the device physics of OECTs and optimize their performance. I will discuss advances in the field drawing examples from studies on devices based on the conducting polymer PEDOT:PSS.

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