Atomic Force Microscopies to study Electronic Properties and Strain in Thin Films for Flexible Electronics.

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Flexible, large area electronics relies on materials and devices that combine electrical functionality with resistance to mechanical deformation. In order to address the full range of possible flexible electronics applications such as sensors, actuators or bioelectronic interfaces, a vast range of electronic materials ranging from conductors and semi-conductors to photoconductors, piezoelectrics or electrochemical interfaces has to be considered. Atomic Force Microscopy and its various derivatives allow to study the morphologies and electronic properties of such materials while they are subjected to mechanical strain. The resulting information provides crucial insight on how strain and electronic properties are entangled at the nanoscale.
In this tutorial presentation I will give an overview of the AFM techniques that we employ in the context of flexible electronics in our laboratory. In particular, two techniques will be detailed: First, Kelvin Probe Microscopy used to study defect formation in organic semiconductors under strain. Second, Piezo-electric force microscopy to investigate materials used for energy harvesting.

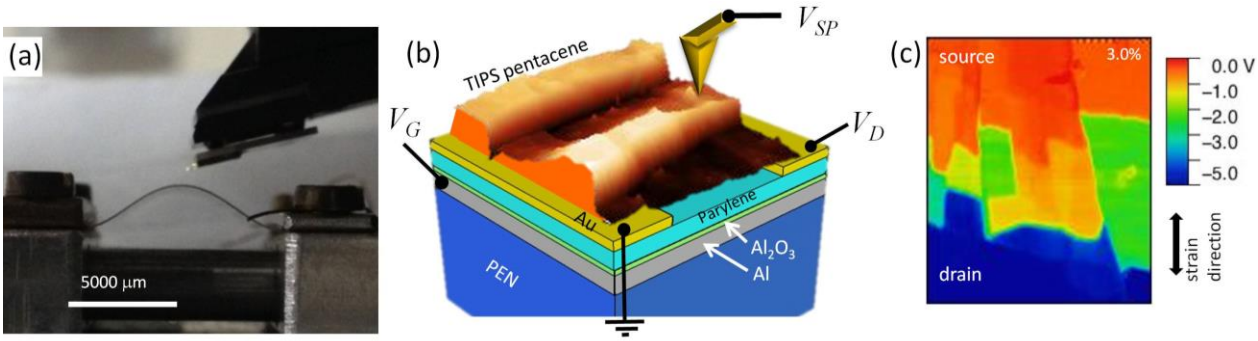

Figure: (a) Photograph of sample and AFM probe hand, (b) scheme showing the sample structure and applied potentials during SKPM, (c) SKPM potential map of transistor channel during 3.0% tensile strain. Abrupt changes in surface potential show local defects reducing charge carrier transport.

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