Organic Bioelectronic Interfaces Investigated by Multichannel Scanning Probe Microscopies

Tobias Cramer[1]
[1]Department of Physics and Astronomy, University of Bologna, Viale Berti Pichat 6/2, 40127 Bologna, Italy

Progress in bioelectronic interfaces relies on novel materials with tailored multifunctional properties to achieve both, a highly efficient transduction process and high biocompatibility enabling low-invasive device operation. The relevant length and time scales at which these properties unfold their impact on the biological systems are on the order of nanometers and micro to milliseconds. Experimental techniques to map surface morphology and electrical, chemical and mechanical properties at these time and length scales are needed to understand and optimize multifunctional bioelectronic interfaces.

In this presentation I will highlight our work on Atomic Force Microscopy to characterize novel bioelectronic materials and interfaces. The focus will be set on multimodal imaging techniques and time resolved methods to study fundamental interactions in soft and stretchable electronic materials and across semiconductor/electrolyte interfaces. Examples are optoelectronic excitations at organic semiconductor based photocapacitors [1], transport in electrolyte gated transistors [2,3] and surface mechanics at soft microcracked electrodes. [4,5]

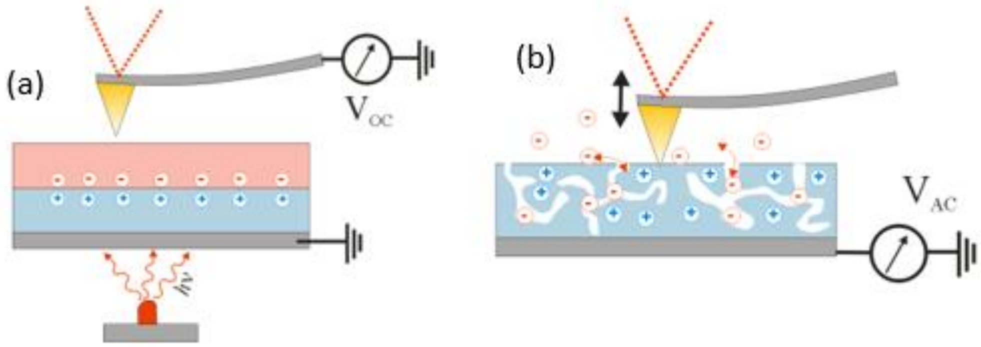

Fig. 1. Nanoscale investigation of bioelectronic actuator surfaces: (a) mapping of photovoltage generation; (b) electroswelling due to ion migration

References:

[1] Paltrinieri, T. et al. Adv. Funct. Mater. 2010116, (2021).
[2] Mariani, F. et al. Small 15, 1–10 (2019).
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[4] Cortelli, G. et al. ACS Appl. Nano Mater. (2021) doi:10.1021/acsanm.1c01590.
[5] Cortelli, G. et al. ACS Appl. Electron. Mat. (2022), 4, 6, 2831-2838.