NANOSCALE TRANSPORT STUDIES OF FUNCTIONAL ORGANIC SYSTEMS

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The charge transport characteristics of organic molecules as well as the ability to control and properly modify these electrical properties represent a key foundation for the field of molecular electronics and the development of novel organic-based electronic devices. In this regard, conductive atomic force microscopy (c-AFM) methods provide unique tools for nanoscale investigations of the plethora of electrical properties provided by organic systems. Here we employ nanoscale I-V spectroscopy as well as spatial electrical current or surface potential mapping approaches to unveil the conducting properties of organic systems which are relevant for device applications.

We correlate the topography and transport properties of metalloporphyrin thin films which present non-homogeneous electrical response due to the formation of nanoscale molecular dendrites and interface defects [1]. We present evidence which allows identifying the proper transport mechanisms of single-molecule magnet systems such as thin films of terbium (III) bis(phthalocyanine) ($TbPc_2$). Here, an electrical spatial mapping of the $TbPc_2$ thin films allows quantifying the charge carrier mobility with nanoscale resolution [2]. We also apply c-AFM methods for the study of the transport properties of important charge-transfer systems such as phthalocyanine-based heterojunctions. The engineering of the organic heterostructure allowed tuning the transport properties as well as identifying transport mechanisms and quantifying the charge carrier mobility of the multilayer systems [3]. A proper understanding of these conditions is fundamental for the search of suitable organic systems and the development of organic-based electronic devices. The approaches presented here represent a starting point towards the development of all-tunable organic-based device technologies.

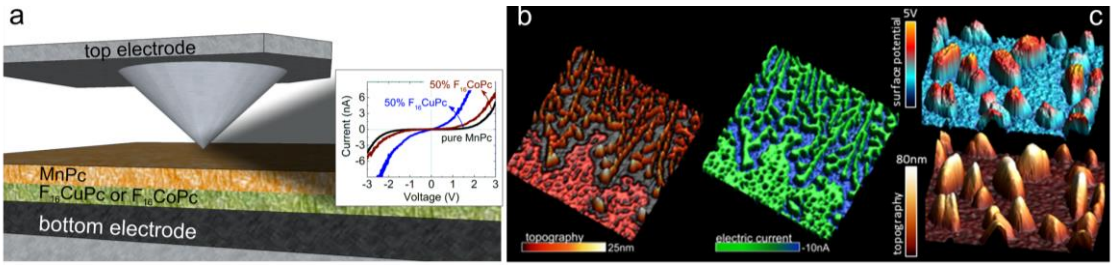

Fig.1. Nanoscale transport studies of organic systems. (a) Tuning of transport characteristics in phthalocyanine thin films *via* incorporation of $F_{16}CuPc$ and $F_{16}CoPc$. (b) Topography and electrical current correlation on molecular dendrites of metalloporphyrins. (c) Spatial surface potential mapping of VoPc and $F_{16}CuPc$ nanocrystals.

Keywords: conductive AFM; transport properties; organic doping; organic systems

References

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