SINGLE QUANTUM-ROD AND SINGLE DEFECT EMISSION POLARIZATION IMAGING OF SOFT NANO-MATERIALS

Arkajyoti Chakrabarty, Guillaume Raffy, Philip Schäfer, Christiaan de Vet, Samuel Marre, Cyril Aymonier, Uday Maitra, André Del Guerzo

1. **Institut des Sciences Moléculaires, CNRS UMR 5255, Université de Bordeaux ; 351 cours de la Libération, F-33400 TALENCE**
2. **ICMCB, CNRS UPR9048, F-33600 Pessac**
3. **Organic Chemistry Department, IISc Bangalore, Bangalore, India**

E-mail : andre.del-guerzo@u-bordeaux.fr

Key Words: single quantum-rod, single molecule, polarization microscopy, nanomaterial, fluorescent materials.

Soft materials are, in a variety of cases, constituted of nano-structures of self-organized small organic molecules and a solvent (organic, oil, water), and can be found in many industrial and technological applications, as well as in bio-materials. It is of major importance to control the molecular packing and the objects' nano-structures, being at the origin of their properties. However, their development requires nowadays imaging techniques that are more evolved and provide deca-nanometer resolution, in solvated materials and preferably dynamically. In this presentation, we will discuss two approaches used to characterize organic nano-fibers and nano-ribbons which present several constraints that inhibit the application of current super-resolution reconstruction imaging based on single molecule detection: the nanostructures are 100% made of fluorescent chromophores (thus impossible to switch off enough to see isolated single molecule blinking); and the materials are based on organic solvents and not water (commercial dyes are not appropriate). In a first case, we used anisotropic core-shell CdSe/CdS quantum-rods (~5-6 nm wide, ~50-60 nm long) to probe the nanostructured surface of the fluorescent nanofibers constituting an organogel of DDOA (2,3-didecyloxyanthracene). The QR's were modified with an appropriate molecular outer shell. These experiments show that by exploiting the linearly polarized emission of the QR's, an orientation map of the QRs can provide information on the orientation of the underlying nanofibers' structure probed at the deca-nanometer scale. In a second case, the molecular packing within blue-emissive nano-ribbons of pure DPA-C16 (2,3-didecyloxy-9,10-diphenylanthracene) could be analysed using single defect fluorescence polarization microscopy. These imaging experiments will be discussed within the frame of more complete studies performed by confocal polarization microscopy combined to crystallographic structural analysis. The nanofibers and nano-ribbons show very versatile emission properties, such as linearly polarized emission and color-tuning at the micro-scale, including white light generation.[1]

[1] C. Giansante, G. Raffy, C. Schäfer, H. Rahma, M.-T. Kao, A. G.L. Olive, A. Del Guerzo, "White Light Emitting Self-Assembled NanoFibers and their evidence by Micro-Spectroscopy of Individual Objects.", *J. Am. Chem. Soc.*, **133**, 316-325 (**2011)**