Anisotropic Photo-Patterning of Fluorescent Nano-Fibers on Isotropic Surfaces: Control of Orientation, Position and Color

L. Gartzia-Rivero*†, K. de Vet*, P. Schäfer*, G. Raffy* & A. Del Guerzo*

**Université de Bordeaux, Institut des Sciences Moléculaires UMR5255 CNRS, 351 cours de la Libération, 33405 Talence, France*
†University of the Basque Country (UPV/EHU), Faculty of Science and Technology, Department of Physical Chemistry, Apt 644 48080 Bilbao, Spain
leire.gartzia@ehu.eus

The organization and patterning of optically active nanostructures on transparent surfaces is proposed using a photo-synthetic approach based on light-triggered self-assembly [1]. Using focused laser irradiation, we target to spatially and temporally control the self-assembly of a small molecule gelator (DDOA, 2,3-didecyloxyanthracene) into fluorescent nanofibers at the surface. The photocleavage of a soluble precursor can be triggered by visible light at 473 nm or two-photon excitation. A confocal microscope set-up is used for writing spatially defined nanostructures and image the photoactive patterns (Figure 1a). Patterning lines and rectangles occurs with a separate control of the nucleation and the growth by laser-scanning and successive wide-field illumination. The patterned nanofibers emit linearly polarized light. The technique provides also the unique possibility to pattern juxtaposed anisotropic micrometric patches of aligned nanofibers on an isotropic surface.
Furthermore, we propose FRET-assisted photo-patterning as a new strategy for a sub-micrometer scale color-tuning in self-assembled fluorescent nanoribbons formed by 2,3-dihexadecyloxy-9,10-diphenylanthracene [2]. The effective incorporation of guest-molecules that function as FRET-acceptors allows high energy transfer efficiencies, giving rise to a macroscopic modification of the emission color. Based on the same principle a simultaneous negative and positive laser-writing is feasible upon photo-oxidation of the acceptor molecules. This allows individual ribbons to be color-tuned locally at the microscopic level (Figure 1b).

References

[1] C. de Vet, Photocontrolled self-assembly of a fluorescent anthracene at nano- and microscales, (Ecole doctorale des Sciences Chimiques, Université de Bordeaux, 2016).
[2] P.Schäfer, Tuning of color and polarization of the fluorescence of nano-ribbons using laser microscopy and controlled self-assembly, (Ecole doctorale des Sciences Chimiques, Université de Bordeaux, 2016).

Figures

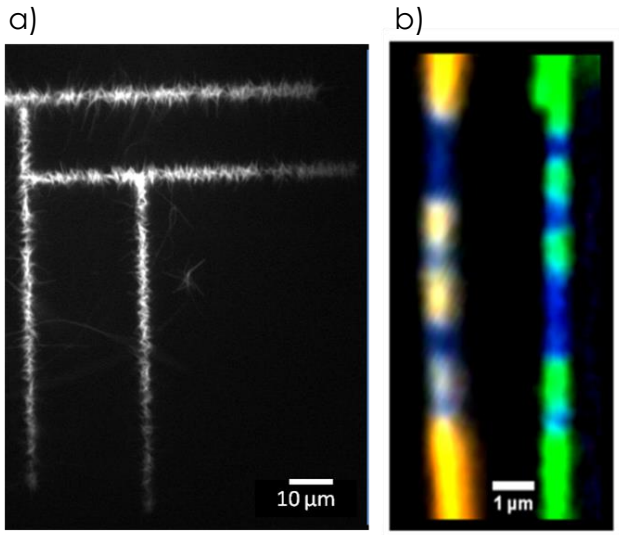

Figure 1: a) Lines of DDOA fibers obtained by repetitive line scans in xy and yx direction with a focused laser. Scale bar is 10 µm. b) Hyper-spectral maps of an orange and a green ribbon patterned in presence of ambient oxygen.

Funding: EC Marie Curie ITN project SMARTNET and Basque Government Postdoctoral Fellowship (L.G-R).