Photoluminescent Organic Materials with Tuneable Emission-Colour and Polarization

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The controlled organization of π-conjugated systems at the molecular, nano- and microscales can lead to materials with exceptional optoelectronic properties. Self-assembly pathways can be controlled by molecular design, concentration, additives, solvent conditions, and temperature [1]. Their optical properties result from tailored molecular design, molecular packing, shape and size, incorporation of suitable dopant-molecules and excitation dynamics [2].

Figures

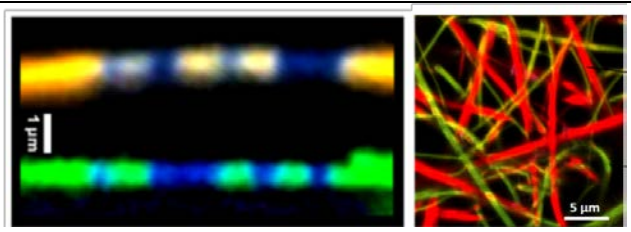

Figure 1: Left: Hyper-spectral map of an orange and a green ribbon patterned in presence of ambient oxygen. Right: Hyper-spectral map of an interpenetrated orthogonal ribbon network.

FRET-amplified photo-patterning is proposed as a new strategy for sub-micrometer scale colourtuning in self-assembled fluorescent nano-ribbons formed by n-acenes [2]. This allows individual ribbons to be colour-tuned locally at a microscopic level (Figure 1, left) with high linear emission polarization. Thereby, combining different molecules and photochemistry at the sub-micrometer scale under the microscope, colourful patterned ribbons could be obtained.
In addition, orthogonal assembly was exploited to grow interpenetrated networks of two novel n-acene derivatives. This study presents a first example of efficient separation between analogue structures, by controlling the self-assembly pathways. These two alkoxylated fluorophores assemble into two separated interpenetrated fiber networks, yielding two-colour emission from the orthogonal gel (Figure 1, right). Interesting changes in optical properties are observed by altering the solvent composition, realizing different colours in consequence of differing molecular packings and thus dipolar coupling. At the hetero-crossings inter-object energy transfer and electroluminescence can be observed.

References

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