One directional Antenna systems: Energy transfer from dye monomers to J-Aggregates along 1D-Aluminphosphates

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Many efforts are focused on the design of artificial antenna systems by mimicking the photosynthesis process. In this sense, host-guest hybrid materials have shown interesting properties, promoting Energy Transfer processes (commonly known also as FRET) among dyes absorbing and emitting in different ranges of the electromagnetic spectrum inserted sequentially into the channels of zeolitic materials.[1,2]

In this work, by the encapsulation of only one fluorescent dyes into the 1-D elliptical nano-channels of magnesiumAlumonifosfate-36, "MgAPO-36" (ATS structure with pore size of 6.7 Å x 7.5 Å similar to the molecular dimmension of the dyes) by crystallization inclusion method a one directional antenna system has been achieved.[3,4] The key of success was the smaller dimensions of the ATS channels that avoid the formation of bulkier H-dimers but instaed red emissive J-type aggregates are observed. As a result, dye/ATS crystals shows an organized multicolor emission, due to the strategic distribution of the dye species along the 1D-channels: monomers at one end, and J-type aggregates at the other end, offering an interesting material susceptible to be used as an artificial photonic antenna and interesting for energy transport (Fig. 1a).

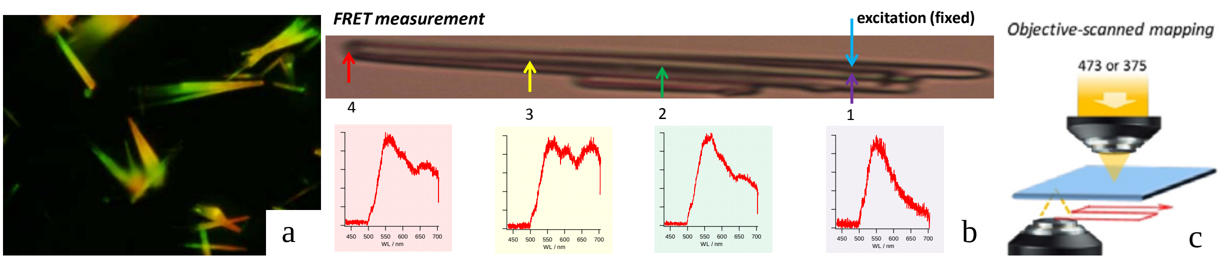

Figure 1. a) Emission image of the PY/ATS crystals. b) Transmission image of PY/ATS particles (Top) and fluorescence spectra detected at points 1 to 4. A 473 nm cw excitation laser was placed at point 1 (bottom). c) Illustrative scheme of remote excitation experiments

The design of these photonic antenna system is based on a very efficient one-dimensional energy-transfer process (FRET: Föster Resonance Energy Transfer) between identical chromophores that have suffered an exciton splitting of their excited states due to the same type of dipole-dipole interactions, as described by Davydov, being the monomers and J-aggregates, the donor and acceptor entities, respectively. In this work is shown experimental evidences of how the excitation energy can be transported along the particle in one direction, by recording fluorescence images in single crystals using remote excitation microscopy technique, *i.e.* the detection spot is scanned over the crystal, while the excitation spot is fixed to monomer region (Fig. 1b and c). The one directional antenna effect was also checked by wide field images (Fig. 2).[4]

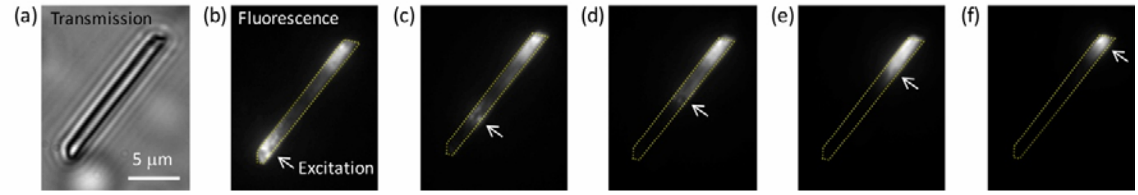

Figure 2: a) Transmission image. b-f) Fluorescence images of of PIC/ATS crystal. Position of the excitation laser of 488 nm is indicated by an arrow in each figure.

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[4] In preparation