MgAPO-based nanostructured materials: in the search of one-directional antenna systems.

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Mimicry of natural processes, such as photosynthesis, has always attracted scientists. However, the synthesis and design of artificial antenna systems is not an easy task. In natural antenna systems, light-energy is harvested and transferred sequentially from a donor to an acceptor, usually chromophores [1]. In this work, artificial antenna systems consisting on different chromophore species *in situ* encapsulated into 1-D nanochannelled magnesium-aluminophosphates (MgAPOs) are synthesized and characterized. In these hybrid materials Fösters Resonance Energy Transfer processes take place between dyes or dye species absorbing and emitting light in different ranges of the electromagnetic spectrum. Furthermore, through the crystallization inclusion method approach, the encapsulation of the dyes is not only performed in a unique step, but also a strategic distribution of the dye species along the nanochannells of the host is achieved, with J-aggregates in one edge of the particles and monomers in the opposite end (Figure 1), enabling a one-directional energy transfer from monomers to aggregates. Following this strategy, different hybrid materials were achieved, incorporating pyronin Y (PY) and/or acridine (AC) [2,3]. The energy transfer in these materials has now been experimentally evidenced by remote excitation microscopy technique [4]. However, in the search of an antenna system in which the energy transfer reaches a longer distance, a material containing a cyanine dye (PIC) with J-aggregates showing intriguing properties, was prepared. A more efficient antenna system was achieved as a result, in which the energy transfer reaches over tens of microns (Figure 2) [4].

References

[1] Gartzia-Rivero, L.; Bañuelos, J.; López-Arbeloa, I., Int. Rev. Phys. Chem., 34 (2015) 515.
[2] Martínez-Martínez, V.; García, R.; Gómez-Hortigüela, L.; Pérez-Pariente, J.; López-Arbeloa, I., Chem. – A Eur. J., 19 (2013) 9859.
[3] García, R.; Martínez-Martínez, V.; Sola Llano, R.; López-Arbeloa, I.; Pérez-Pariente, J., J. Phys. Chem. C, 117 (2013) 24063.
[4] Sola-Llano, R.; Fujita Y.; Gómez-Hortigüela, L.; Alfayate, A.; Uji-I, H.; Fron, E.; Toyouchi, S.; Pérez-Pariente, J.; López-Arbeloa, I.; Martínez-Martínez, V., ACS Photonics (2017) Ahead of print. DOI: 10.1021/acsphotonics.7b00553

Figures

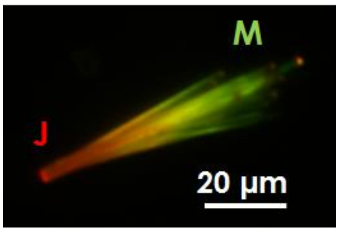

Figure 1: Fluorescence image of a PY/MgAPO-36 particle bouquet under blue excitation.

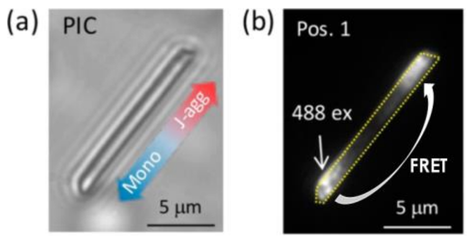

Figure 2: Transmission (a) and fluorescence intensity image (b) of a PIC/MgAPO-36 particle. 488 nm excitation was fixed at position pointed with an arrow.