Nonlinear Optics through optimal dye encapsulation into zeolitic nanochannels

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In this work, a styryl dye (trans-2-[4-[(dimethylamino)styryl] benzothiazole, DMASBT) is encapsulated into several aluminophosphates (MgAPO-11, MgAPO-5 and MgAPO-36, Figure 1) with different unidimensional nanochannel dimensions by the crystallization inclusion method. The synthesis of the hybrid material has been optimized through a systematic variation of the conditions in order to obtain the ideal optical properties for our hybrid system [1].

The tight-fitting between the molecular size of the guest dye and the pore dimensions of the host, favour a rigid planar conformation of the dye, restricting its inherent flexibility and boosting its fluorescence. The latter is crucial to enhance the non-linear optical (NLO) properties of the dye, which has successfully been achieved only in the particular case of MgAPO-11 framework.

Not only does the pore size of the framework lead to distinctive photophysical properties but also the formation of two different cationic species during the synthesis. In this sense, the pH plays a key role since allows us to adjust the amount of the desirable cationic species [2]. Therefore, the perfect alignment of DMASBT dye along the channels of MgAPO-11 has led to attractive non-linear optical properties, proven through microscopy measurements (Figure 2).

References

[1] Sola-Llano, R.; Martínez-Martínez, V.; Fujita, Y.; Gómez-Hortigüela, L.; Alfayate, A.; Uji-i, H.; Fron, E.; Pérez-Pariente, J.; López-Arbeloa, I., *Chem. Eur.*, 22 (2016), 1-13
[2] Saha, S. K.; Purkayastha, P.; Das, A. B., *Photochem. Photobiol. A Chem.,* 195 (2008), 368-377

Figures

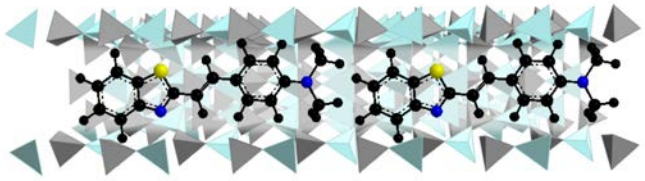

Figure 1: DMASBT dye molecules inside the unidirectional nanochannels of MgAPO-11 aluminophosphate.

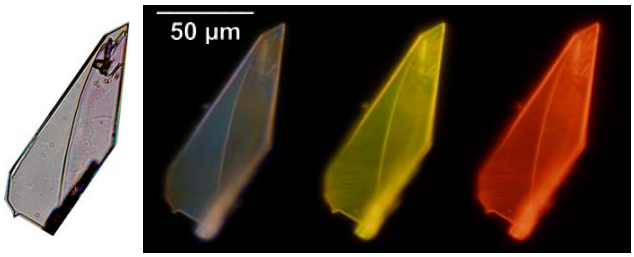

Figure 2: Transmission (white background) and emission images (black background) of a DMASBT-AEL single-crystal upon UV light, blue light and green light excitations.