Anisotropy study of Dye Intercalation into 1D Sepiolite clay fibers by Fluorescence Microscopy

Teresa Arbeloa, Virginia Martínez-Martínez, Cecilia Corcostegui, Leire Gartzia, Jorge Bañuelos and Iñigo López Arbeloa.

Departamento de Química Física, Universidad del País Vasco UPV-EHU, Apdo. 644, 48080-Bilbao, Spain
virginia.martinez@ehu.es

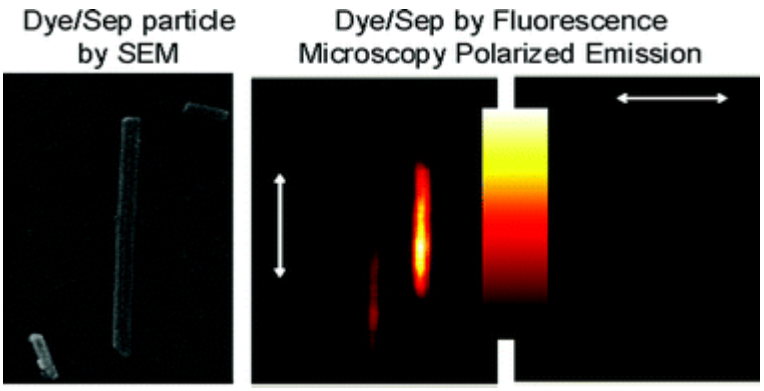
The encapsulation of dyes into nanostructured ordered systems is a good tactic to provide new functional materials. On the other hand, a great variety of solid matrices with different 1-, 2- or 3-dimension arrays are suitable to induce an anisotropy orientation on the guest molecules.

In this sense, nanotubes and nanostructured tubular systems with elongated pores can act as a powerful ordering framework in one dimension for the guest species. Sepiolite, Sep, is a very special magnesium silicate clay, with rod-like particles with interior rectangular tunnel-likes pores of 3.6Å x 10.6 Å and external channels along a-axis which offers a large specific area and porosity and is a good hosts to get 1D highly order in suitable dye/clay hybrid functional materials.

In this work, four fluorescent dyes with different molecular dimensions, Rhodamine 6G (R6G), Pyronine Y (PY), Styryl 698 (LDS 698) and Styryl 722 (LDS 722), are encapsulated into Sepiolite clay at low and high loadings.

An study of single dye/Sep fibers was performed by Confocal Fluorescence Microscopy. The combination of Fluorescence Lifetime Imaging (FLIM), polarized fluorescence intensity experiments and spectral resolution shows a straightforward method to study the molecular distribution inside the tunnels and/or at the external channels, the dye orientation (evaluated by the fluorescence dichroic ratio, D) and the formation of different dye species (monomer and aggregates). The ability of the dyes to penetrate into the Sep tunnels is R6G < LDS 698 < PY < LDS 722, analyzed by thermal analysis. As a result the alignment along the main axis of Sep increase in the same order reaching fluorescence dichroic ratios of around 1.5, 6, 8 and 10 respectively for each dye.

In summary, to favor internal over external adsorption in the Sep and therefore the alignment along the fiber direction, dyes with small thickness and long main molecular axis are the best candidates.



References

[1] Virginia Martínez Martínez, Cecilia Corcósteguia, Jorge Bañuelos Prietoa, Leire Gartzia, Sandra Salleres and Iñigo López Arbeloa, . **J. Mater. Chem.,** 2011, 21, 269-276.