Mechanism of organic dyes aggregation in aliphatic phase change materials

Giuseppina Massaro[1], Jordi Hernando[2], Daniel Ruiz-Molina[3], Claudio Roscini[3], Loredana Latterini[1]

[1] University of Perugia, Chemistry, Biology and Biotechnologies Department, via Elce di sotto, 8, 06123 Perugia, Italy
[2]Departament de Química, Universitat Autònoma de Barcelona, Edifici C/n, Campus UAB, 08193 Cerdanyola del Vallès, Spain
[3] Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and The Barcelona Institute of Science and Technology, Campus UAB, Bellaterra, 08193 Barcelona, Spain

E-mail: pinamassaro9@gmail.com
present address: Institute of Chemical Research of Catalonia (ICIQ) Avda. Països Catalans, 16, 43007 Tarragona, Spain

Polycyclic aromatic molecules have always attracted a great interest for their fluorescence properties in liquid solution and solid materials and are proposed for many different applications.[1,2] The photophysical behavior of anthracene and some derivatives is herein explored in aliphatic-based phase change materials (PCMs) such as eicosane (EC). Absorption, steady state emission and time resolved fluorescence investigations revealed that the solid-liquid transition of the PCM induces reversible modifications of the optical properties of aromatic dyes due to variations in both ground and excited electronic states. The low solubility of the aromatic dyes into the aliphatic environment,[3] as the solid PCM, induces the phase separation of the dyes which self-aggregate yielding different absorption and emission properties.[4] The switch from monomer-to-excimer emission was thus easily achieved through the liquid-to-solid transition of PCMs. The presence of an additional dye has been investigated as well and it can strongly affect the emission properties of the polycyclic dye in the PCM solid state (Fig. 1a). Therefore, by simply controlling the power density, the temperature and the molecule (or pairs of molecules) in the PCM an easy tuning of the emission wavelength over the color diagram could be achieved (Fig. 1b).

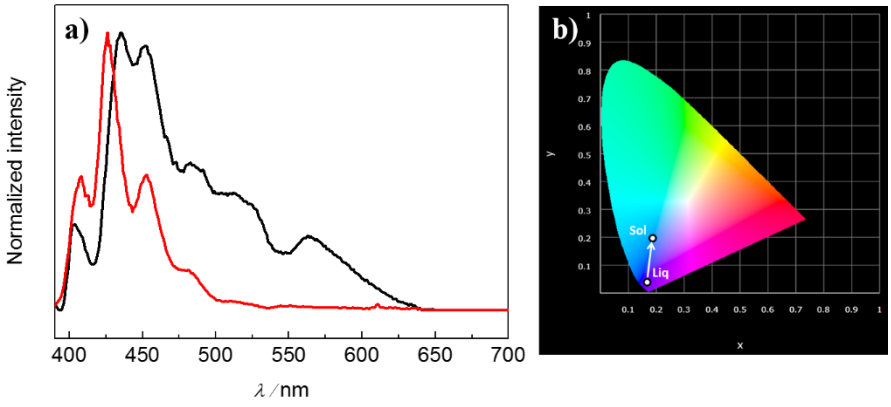

Figure 1 a) Normalized emission spectra of 9, 19-dimethylanthracence recorded in liquid (red line) and solid (black line) phase of EC in presence of a platinum octaethyl porphyrin. Upon PCM solidification, the DMA excimer emission band (between 500 nm and 650 nm) is observed. b) Variation of CIE emission coordinates of the system DMA-PtOEP obtained through liquid-to-solid EC transition.

References:

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