Multi-Stimuli Responsive Emitting Materials

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Temperature- and light-tunable emitting materials are gaining interest for their potential applications in molecular memories, fluorescent inks, lightning, sensing or imaging.[1] Nevertheless, the current strategies to prepare these systems generally require the use of stimuli-responsive thermochromic[1a] and photochromic[1b] dyes, which entail severe disadvantages such as expensive and long syntheses and limited stability. To overcome these obstacles, we are exploring a new strategy based on low-cost phase change materials (PCMs, e.g., paraffins) and their capacity to modulate the emission properties of regular organic fluorophores through solid to liquid transition.[2] In this work we demonstrate that this is a general, reversible, robust and very versatile behavior arising from the variation in emitter-matrix, emitter-emitter and emitter-additive interactions that occur when melting the solid crystalline PCM host where the luminescent molecules are dispersed in. As a result, a broad range of thermoresponsive fluorescent systems can be easily prepared that show ample tunability in emission colors, thermal responses and switching schemes by merely altering the PCM and dye of choice. In addition, those themofluorochromic dye-PCM mixtures can be structured into small nanoparticles, which allows the preparation of transparent labels and colloidal inks that can be easily integrated into functional devices (Figure 1). Finally, this methodology can also be used to produce photoresponsive fluorescent materials by simply adding gold nanoshells (AuNSs) to the system, as PCM melting can be alternatively induced by the photothermal effect generated by the NIR-absorbing AuNSs when irradiated. Because of these combination of properties, our strategy towards temperature- and light-tunable emitting materials shows great promise for the preparation of a wide variety of functional materials with applications ranging from (bio)imaging to security printing and sensing.[3]

Figure 1. *NIR- and temperature-responsive emissive materials.*

References

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