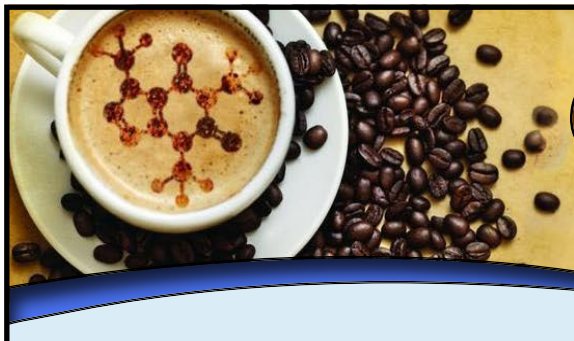

# CoffeeTalk@ISOF

**EXTENDED EDITION**

# Hybrid organic-inorganic systems as light-harvesting antennae


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An antenna for light harvesting is an organized multicomponent system in which many chromophoric molecular units absorb the incident light and then channel the excitation energy to a common acceptor component.[1] Two different approaches will be discussed: (i) a multiterpyridine system coupled to a hexathiophenyl benzene core exhibiting aggregation induced phosphorescence[2] and (ii) a family of Silicon nanocrystals (SiNCs) functionalised by organic chromophores.[3]

In the first system, $Mg^{2+}$ complexation turns on phosphorescence of the hexathiophenyl core. Metal ion coordination yields the formation of a supramolecular polymer which hinders intramolecular rotations and motions of the core chromophore, thus favoring radiative deactivation of the luminescent excited state. Upon excitation of the $[Mg(tpy)_2]^{2+}$ units of the polymeric structure, sensitization of the core phosphorescence takes place with >90% efficiency. The light-harvesting polymeric antenna can be disassembled upon fluoride ions addition, thereby switching off luminescence and offering a new tool for fluoride ion sensing.

The second approach is based on silicon nanocrystals that, in the quantum size range (2-12 nm), can be made as viable light emitters with emission wavelength that can be tuned from the near-infrared (NIR) into the visible by decreasing their size. Covalent Si-to-carbon bonding also offers the possibility of integrating inorganic and organic components into robust structures. In the present work, the H-terminated nanocrystals were used as a platform for co-passivation with dodecene and different organic chromophores by thermal hydrosilylation. For example, we functionalised two families of SiNC of average diameter of 2.5 and 5 nm with pyrene chromophores: pyrene excitation results in a very efficient (> 95%) energy transfer to the nanocrystal core.[3] To the best of our knowledge this is the first time in which highly efficient light harvesting from photoactive units to the silicon core has been demonstrated. This approach enabled us to circumvent the drawback of the low molar absorption coefficient of SiNCs. The investigated hybrid material exhibits high quantum yield (40%) also in the NIR spectral region with lifetime in the μs range.

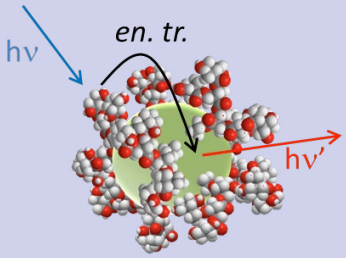


**Figure 1.** Schematic representation based on functionalized silicon nanocrystals.

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*Her research on dendrimers and nanoparticles toward photovoltaic applications has been funded by an ERC Starting Grant.*

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1) *Photochemistry and Photophysics: Concepts, Research, Applications*, V. Balzani, P. Ceroni, A. Juris, Wiley-VCH, **2014**, ch. 10.

2) A. Fermi, G. Bergamini, M. Roy, M. Gingras, P. Ceroni, *J. Am. Chem. Soc.* **2014**, 136, 6395-6400.

3) See e.g., R. Mazzaro, M. Locritani, J. K. Molloy, M. Montalti, Y.Yu, B. A. Korgel, G. Bergamini, V. Morandi, P. Ceroni, *Chem. Mater.* **2015**, 27, 4390–4397.


## *Thursday 14 April 2016, 14:30*

## ISOF 12 – Meeting Room (1st floor)

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