Luminescent Silica Nanoparticles: Extending the Frontiers of Brightness

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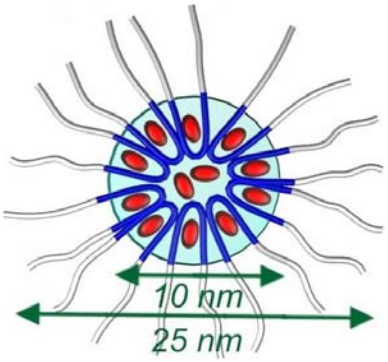
Silica nanoparticles are versatile platforms with many intrinsic features, including a low toxicity. Proper design and derivatization yield particularly stable, very bright nanosystems displaying multiple functions, which can be used for either photoluminescence (PL) or electrochemiluminescence (ECL) sensing, labelling or imaging applications [1,2]. For these reasons silica nanoparticles already offer unique opportunities, and further improvement and optimization can substantially increase their applications in fields of high impact, such as medical diagnostics and therapy, environmental and food analysis, and security.

This contribution describes silica-based multi-component nanoparticles, tailored for optimization of processes such as directional energy transfer, which provide those systems with extremely valuable functions: high light-harvesting capability, signal-to-noise maximization, multiplex output, and signal amplification. A particular emphasis will be given to the description of a family of silica-core/PEG-shell nanoparticles, (see scheme 1) that we have recently developed in our laboratories.



Scheme 1: Cartoon of silica-core/PEG-shell nanoparticles as described in refs. 1-3

[1] S. Bonacchi, D. Genovese, R. Juris, M. Montalti, L. Prodi, E. Rampazzo, and N. Zaccheroni, *Angew. Chem. Int. Ed. 50*, **2011**, 4056.
[2] S. Bonacchi, D. Genovese, R. Juris, M. Montalti, L. Prodi, E. Rampazzo, M. Sgarzi, N. Zaccheroni, *Top. Curr. Chem. 300*, **2011**, 93.
[3] S. Zanarini, E. Rampazzo, S. Bonacchi, R. Juris, M. Marcaccio, M. Montalti, F. Paolucci, L. Prodi, *J. Am. Chem. Soc. 131*, **2009**, 14208.