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Spot the Magic Dot!

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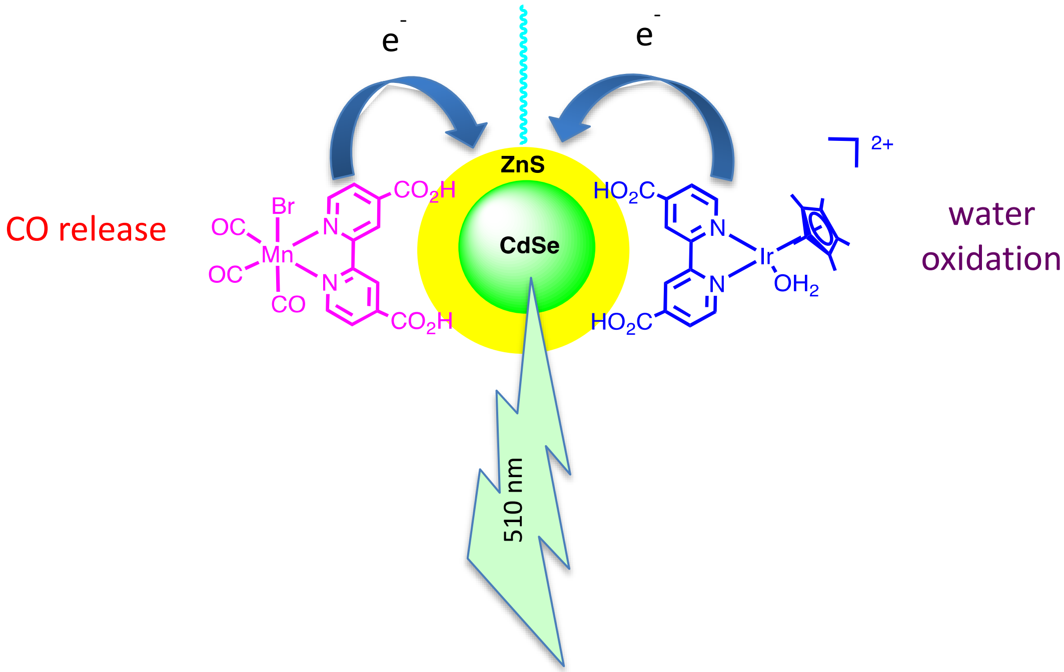
Quantum Dots are semiconductor particles of nanometric size. Because of their small size, they present peculiar properties due to the quantum confinement effect: their fluorescence emission and redox properties can be tuned with size, thus enabling to obtain luminophores with tailored properties. Together with their photostability and high optical efficiency (in the presence of suitable capping units), the possibility of finely tuning optoelectronic properties during the synthesis makes them ideal candidate for many applications. In fact, Quantum Dots have been recently used for a variety of scopes: among the most intriguing applications it is possible to mention medical diagnostic (as luminescent imaging agents), realisation of optoelectronic devices and, more recently, sensitizers for solar cells.[1]

We are currently investigating the photochemical properties of systems based on Quantum Dots functionalised with transition metal complexes, which find applications for the development of phototherapeutical agents and in artificial photosynthesis.

The realisation of light-driven systems capable of releasing small bioactive molecules (like CO and NO) is a very active research field. The possibility of inducing CO and NO release upon irradiation with visible light constitute an important goal for photomedicine. The systems realised so far usually require the excitation with UV or blue light, making them unsuitable for practical applications.[2] By using Quantum Dots functionalised with Mn(I) complexes we were able to develop the first example of a system which releases CO upon photoexcitation with green light (510 nm) with a superior efficiency (200%) with respect to the pristine Mn(I) complex.

Artificial photosynthesis (i.e. the light-driven splitting of water to generate hydrogen and oxygen) is undoubtedly one of the Holy Grails of modern research.[3] In the last three years some Quantum Dots-based systems have been reported, capable of reducing protons to hydrogen in the presence of sacrificial species.[4] However, no systems are known capable of performing water oxidation (a crucial step towards water splitting). We have recently studied the electron transfer process of Quantum Dots conjugated with Ir(III) complexes, which are suitable for water oxidation.

The results obtained so far in these investigations will be presented, pointing out the challenges and the perspectives of such fascinating systems, lying between nanotechnology and coordination chemistry.



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