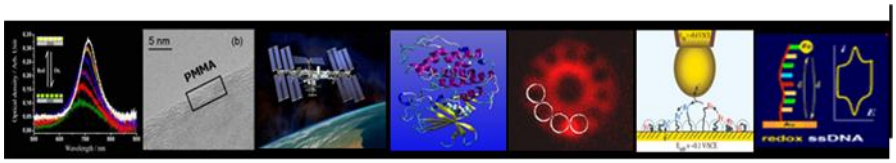

Séminaire de Chimie Autour des Nanosciences

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STIMULI-RESPONSIVE MICROGELS: NEW OPPORTUNITIES FOR SIGNAL AMPLIFICATION IN ELECTROCHEMISTRY?

Responsive materials comprise an attractive field of study due to their possible applications in regenerative medicine, biological coating technologies, drug delivery, and (bio)sensing. In particular, hydrogels made of water-soluble cross-linked polymers, are interesting for these types of applications due to the flexibility of their networks in aqueous media, the degree to which their mechanical and chemical properties can be tuned, and their intrinsic compatibility with biological systems. Our work focuses on colloidal hydrogel particles, called microgels, which exhibit faster kinetics and allow reaching small targets such as biological cells. Different classes of microgels have been developed, with sizes ranging from hundred nanometers to hundreds of micrometers and various responsiveness including temperature, pH, but also glucose.

In this presentation, we will focus on responsive redox microgels. Prototypical poly(N-isopropylacrylamide) (pNIPAM) microgels were functionalized with Ruthenium(II) polypyridine complexes, a redox and luminescent moiety. We will describe their photoluminescent, electrochemical and electrochemiluminescent (ECL) properties in various configurations. In solution, they exhibit reversible ECL enhancement upon collapse, with an amplification of the light emission reaching 2 orders of magnitude[1]. This amplification is all the more unexpected since it is antagonistic to the gating effect of the hydrogel matrix on the diffusion of other soluble redox species[2]. We have shown that the concept can be nicely applied to the development of glucose-responsive systems. These studies open new perspectives towards applications in ultrasensitive bioassays.

To go one step further, we have also studied a multiscale-organized system, in which the microgels were adsorbed at the oil-water interface and stabilized emulsion drops[3]. 2D ECL was observed where the light emission was confined in the interfacial film at the surface of the drops. These results are promising for the study of compartmentalized systems and interfacial phenomena.

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