Stimuli-responsive microgels-based capsules constructed from all-aqueous coacervate droplets

Ritu Toor[1], Valérie Ravaine[1], Adeline Perro[1]

[1] Université de Bordeaux, CNRS, ISM, UMR 5255, Bordeaux INP, Pessac, France.

adeline.perro@enscbp.fr

Stimuli-responsive capsules are soft materials that combine confinement with dynamic control over permeability and transport. By responding to external triggers such as temperature, pH, or ionic strength, they allow reversible tuning of both structural and interfacial properties. An especially attractive strategy to design such systems relies on water-in-water emulsions, which provide ultra-low interfacial tension and fully aqueous environments. Here, we present a fully aqueous approach to fabricate stimuli-responsive colloidal capsules based on microgel assemblies at liquid–liquid interfaces.
All-aqueous phase separation typically arises when two water-soluble components are mixed, a phenomenon known as coacervation. In the case of self-coacervation, a single macromolecular species separates into micrometer-sized liquid droplets. Building on this concept, we exploit ampholyte polymer chains to generate highly stable micrometric coacervate droplets. Thermoresponsive poly(N-isopropylacrylamide) (PNIPAM) microgels adsorb at the coacervate interface and are subsequently interlinked by UV-initiated polymerization, forming a robust microgel membrane. After dissolution of the coacervate core, the capsules remain intact and display a permeable shell whose transport properties are governed by the microgel swelling state. The membrane exhibits size-selective permeability toward Brownian nanoparticles and can be dynamically modulated by temperature. Altogether, this system provides a versatile model platform to investigate adaptive interfacial assemblies and responsive transport in soft colloidal capsules.

Keywords:
Coacervates, microgels, all-aqueous emulsions

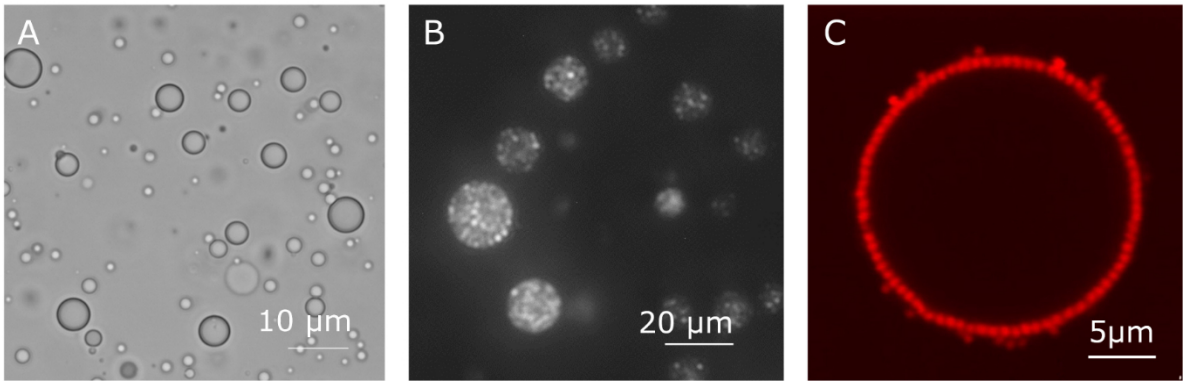

Figure 1: A) Optical microscopy image of coacervates. B) Fluorescent images of polystyrene latex sequestrated in coacervates. C) Confocal image of microgels-based capsule through the coacervation templating method.

References:

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