Control the partitioning of Pickering miniemulsion particles in bicontinuous interfacially jammed emulsion gels (bijels)

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Bicontinuous interfacially jammed emulsion gels (bijels) feature intertwined, continuous water and oil domains separated by a densely packed nanoparticle layer at the interface [1]. Most applications utilize the jammed interfacial layer or solidify one of the continuous channel as a scaffold [2,3]. However, the incorporation of additional functional particles within the continuous channels remains unexplored.

We synthesize Pickering miniemulsion particles that serve as fluorescent tracers which has a polymer core fully armored by a shell of silica nanoparticles [4]. The polymer core can incorporate a range of lipophilic dyes, allowing flexible selection of excitation and emission wavelengths. The silica shell enables robust surface modification, providing delicate control over particle surface properties.

By tuning the degree of silane functionalization, we observe a transition in particle partitioning from dispersing in the water phase, then attaching to the interface, and finally to the oil phase. This behavior is achieved through the signature in-situ particle modification during the solvent transfer-induced phase separation (STrIPS) process. We attribute the transition to the interaction between the functionalized surface groups and surfactants.

This work opens up the possibility to introduce multiple types of functional particles into bijels, thereby facilitating applications in catalysis and energy storage.

Keywords:
Bijels, Miniemulsion, Pickering emulsion

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