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Self-Assembled Nanostructured Microgels with Reconfigurable Morphologies

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Bent-core (BC) molecules, owing to their distinctive angular geometry, are known to form liquid crystalline (LC) organizations characterized by compact, anisotropic, and often polar structures. Here, we present a new class of complex droplet emulsions based on bent-core amphiphiles, in which LC-like self-assembly is confined within a colloidal architectures. Molecular designs incorporating biphenyl or ester lateral units together with tetraethylene glycol–based and alkyl chains promote efficient aggregation pathways and robust organogel formation.[1] These organogels preserve LC-like order within the gel phase and form fibrillar, tubular, and helical supramolecular characteristic of helical nanofilament (HNF)–type organizations.

Specifically, through bulk emulsification into aqueous media, we generate nanostructured supramolecular microgels that retain their internal fibrillar and HNF-like architectures within discrete micrometer-sized droplets. To the best of our knowledge, this represents the first example of nanostructured microgels formed through the self-assembly of low-molecular-weight amphiphiles. Extending beyond single microgels, this strategy enables the formation of complex emulsions in which an organogel compartment coexists with a fluorocarbon oil, yielding multicompartment droplets with dynamically reconfigurable morphologies,[2] including organogel-in-fluorocarbon-in-water (OG/F/W), Janus, and fluorocarbon-in-organogel-in-water (F/OG/W) configurations.

The self-assembly of bent-core amphiphiles into nanostructured organogels with HNF-like order, combined with their emulsification into microgel droplets capable of reversible morphological transformations, opens new opportunities for adaptive soft materials with potential applications in sensing, controlled delivery, bioimaging, and photonics.

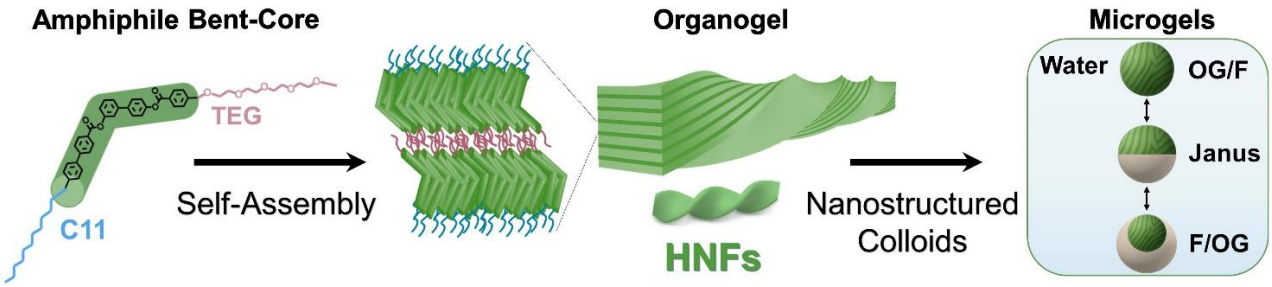

Figure 1. Schematic illustration of bent-core amphiphiles and their hierarchical self-assembly from individual units into supramolecular organogel structures featuring HNF-type organizations, ultimately leading to the formation of complex nanostructured microgels with tunable morphologies.

References

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