BIOPOLYMERS, NANOPARTICLES AND SURFACTANTS: SHORT STORIES IN BUILDING-UP GELS FROM SELF-ASSEMBLY

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Hydrogels obtained from the chemical and physical association of macromolecules, surfactants and nanoparticles, are a huge area of materials science and have found numerous applications in food, personal care products and biomedicine. The macroscopic properties of hydrogels are a complex interplay between the microscopic and mesoscopic supramolecular organization; thus, both their dynamics and structure are dictated by the interactions between the constituents, the fabrication pathway and resulting spatial organization over different length scales. Work in our group has explored various approaches to make gels from non-covalent interactions, spanning biopolymers[1-4], wormlike micelles[5,6] or host-guest interactions with cyclodextrins[7-9].

Biopolymers offer a number of advantages over their synthetic counterparts, but suffer from a lack of characterization. This talk will describe our approach to make cheap, functional materials based on widely available biopolymers obtained from natural sources, such as gelatin, or polysaccharides.[1-4,10] We will describe the impact of using a hybrid gelation process, combining physical gelling and chemical cross-linking, as well as gels made from hydrophobic interactions between modified biopolymers (dextran or gellan gum) with surfactant micelles.[10] Time allowing, I will report on some recent work involving surfactants and laponite architectures, leading to pH- and temperature-responsive gels. The nanoscale morphology of these gels is characterized by small-angle neutron scattering, which is correlated to the rheology of the gels to extract useful structure-function relationships.

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