RESPONSIVE MICROCAPSULES FROM COMPLEX EMULSIONS

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Engineered microcompartments and capsules that respond to multiple external stimuli and partly replicate key features of the fascinating dynamic response of living cells have attracted growing interest in academia and industry. In this talk, I will present our efforts to create a library of chemically- and mechanically-responsive microcompartments that are able to release cargo molecules on-demand through different triggering mechanisms. To obtain microcapsules with unprecedented functionalities, we use complex emulsions made in microfluidic devices as soft templates. Conversion of soft double emulsions into functional microcapsules is accomplished by a polymerization reaction or dissolution of the oil phase into the continuous medium, thus generating polymer-based compartments or colloidosomes with predictable size, shell thickness, mechanical behavior and shell microstructure. The resulting microcapsules can be designed to undergo one-time release or can be made sufficiently robust to enable multiple release events without impairing the compartment's mechanical integrity. Release is triggered by a variety of external stimuli, including pH, temperature or magnetic fields. Proof-of-concept experiments are shown to illustrate the potential of these microcompartments in modifying on-demand the mechanical response of organic or inorganic matrices in capsule-loaded composite materials.