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# Functional and responsive core-shell nanoparticle assembly at oil and lipid interfaces

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Carefully controlled core-shell nanoparticles can be used in biomedical applications, e.g., as biomedical imaging contrast agents, for hyperthermia and in drug delivery [1, 2], as well as for biotechnological applications such as separation and purification. Unique material functions can be achieved by using nanoscale inorganic cores, such as plasmonic or superparamagnetic interactions with electromagnetic fields. However, to enable these functions in a biological environment a dense organic shell has to control colloidal interactions with biomolecules, cells and other nanoparticles [1, 3]. Control over nanoparticle physical properties through an organic shell also allows tailoring of the assembly of functional nanoparticles into supramolecular structures, such as nanoscale vesicles or nanoscale Pickering-type emulsomes. The self-assembled structures can incorporate environmentally responsive building blocks and therefore be controlled through the strong interaction of the inorganic core with externally applied electromagnetic fields.
I will describe multiple recent developments from our lab regarding the synthesis and assembly of superparamagnetic core-shell nanoparticles that illustrate this design philosophy. The combination of new organic shell grafting methods [3-7] and control over nanoscale self-assembly [8-13] has allowed us to vastly improve performance of superparamagnetic core-shell nanoparticles, perform detailed investigations of interactions of colloidal responsive nanoparticles as well as demonstrate unprecedented control over magnetically controlled nanovesicular and nanoemulsion systems for transport and release applications that could impact future directions in drug delivery and biomedical imaging.

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