Reversible Surface Charge Control through Supramolecular Chemistry

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The properties of nanomaterials are largely dependent on the size and morphology of nanoparticles, as well as on their organization within nanostructured materials. A large number of synthetic methods have been developed, which allow an exquisite degree of control over these parameters. One of the most important factors behind particle growth and interparticle interactions is the chemical composition of the nanoparticles' surface, which often involves the presence of organic ligands, usually surfactants or polymers. These ligands can be used to protect specific crystallographic facets in nanocrystals, to facilitate binding to other molecules or surfaces, but also to direct the assembly of the nanoparticles into well-defined nanostructures.
We describe an approach to regulate the surface charge on gold nanoparticles, using supramolecular chemistry. The strategy relies on the functionalization of AuNPs with negatively charged pyranines, which largely hamper their penetration in cells. Cellular uptake can be activated in situ through the addition of cationic covalent cages that specifically recognize the fluorescent pyranine dyes and counterbalance the negative charges. The high selectivity and reversibility of the host-guest recognition activates cellular uptake, even in protein-rich biological media, as well as its regulation by rational addition of either cage or pyranine.

References

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