Novel Photonic Materials from Self-Assembly of Coated Colloids

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The extension of the layer-by-layer (LbL) technique[i] to colloids has enabled the production of novel core-shell materials[ii] comprising charged colloidal particles coated with polyelectrolytes, proteins, metal or semiconductor nanoparticles, metal oxides etc. Thus, the LbL coating strategy provides independent control over thickness and composition of the shell-wall (by prescribing the number of coating layers and the coating material). In addition, the size of the core can be controlled by appropriate choice of the latex sphere size. We describe the preparation of coated colloidal materials and their self-assembly to form periodic three-dimensional crystalline arrays. Such ordered assemblies have attracted considerable attention in recent times due to potential applications in the area of photonics[iii]: our ability to control the lattice parameters, wall thickness and refractive index in the opaline materials opens up a versatile and attractive route to tailor optical properties. Further, removal of the cores to produce hollow spheres[iv] yields inverse opal materials that are predicted to have a complete photonic band gap. The optical characterization of our self-assembled materials and the influence of the coatings on tunability of optical properties will be discussed.

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