Self-assembled superstructure of DNA-coated colloidal clusters and spheres: a diamond and pyrochlore lattice

이기라†
성균관대학교
(yigira@skku.edu†)

Colloidal crystals of overlapping dielectric spheres arranged in a lattice with diamond or related symmetry is predicted to exhibit unusual optical properties, including a large omnidirectional photonic band gap. Self-assembly has long been thought to be a promising approach for making photonic crystals, but has failed to produce an interconnected lattice with diamond or related symmetry that might realistically exhibit a photonic band gap. Here we employ a new strategy of mixing spheres with tetrahedral clusters, and demonstrate their self-assembly into a superlattice of two interpenetrating sublattices, one diamond and the other pyrochlore. Each of these sublattices is predicted to have a wide robust photonic band gap. The self-assembly of these crystals is made possible by using clusters, which facilitate efficient particle packing and reduce the entropic cost of crystal formation, and by the selective use of DNA-coated colloids to control the specific interactions between particles and clusters. These results open a viable pathway for the self-assembly of colloidal crystals with full omnidirectional photonic band gaps.