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Lock-and-Key Colloids[1]

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We have developed a new kind of colloidal particle that is spherical but with one or more spherical dimples in the particle surface. These dimples serve as docking points for colloidal spheres whose radius matches the radius of dimples. The attractive docking force is provided by the depletion interaction and can be controlled by changing the depletant concentration or, in some cases, the temperature. The docking is completely reversible and mimics the classic lock-and-key interaction often used to describe protein binding. The lock-and-key binding is size specific and can be used to assemble a number of interesting colloidal superstructures, including flexible jointed chains, dumbbells, trimers, tetramers, and other assemblies. A new synthetic method for making the dimpled particles can be generalized to make a number of other new structured colloidal particles, with different functionalities analogous to block copolymers.

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