The Robust Assembly of Small Symmetric Nanoshells.

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Highly symmetric nanoshells are found in many biological systems, such as clathrin cages and viral shells. Many studies have shown that symmetric shells appear in nature as a result of the free-energy minimization of a generic interaction between their constituent subunits. Here, we study the physical basis for the formation of symmetric shells, and by using a minimal model, demonstrate that these structures can readily grow from the irreversible addition of identical subunits. Our model of nanoshell assembly shows that the spontaneous curvature regulates the size of the shell while the mechanical properties of the subunit determine the symmetry of the assembled structure. Understanding the minimum requirements for the formation of closed nanoshells is a necessary step toward engineering of nanocontainers, which will have far-reaching impact in both material science and medicine.