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Directing the self-assembly of polyhedral silver nanocrystals MICHAEL GRUENWALD, University of California at Berkeley, JOEL HENZIE, ASAPH WIDMER-COOPER, PHILLIP GEISSLER, PEIDONG YANG — Self-assembly of nanocrystals with complex shapes requires precise control of nanoscale interactions and driving forces. Here we show with experiment and simulation that large 3D supercrystals with exceptional order can be assembled by tuning the shape and attraction between polyhedral building blocks. When passivated with adsorbing polymer, Ag nano-polyhedra can behave as quasi-hard particles, and assemble into their densest known packings under a simple gravitational driving force. Excess polymer in solution induces depletion attractions that can stabilize less dense, ordered packings. In the case of octahedra, controlling polymer concentration allows us to tune between the well-known Minkowski lattice, and a novel packing with complex helical motifs. Such large-scale ordered arrangements of Ag nanocrystals provide many possibilities for designing scalable 3D plasmonic metamaterials with applications including chemical and biological sensing, nanophotonics and photocatalysis.

Michael Gruenwald
University of California at Berkeley

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