University of Maryland NSF-MRSEC Highlight:

Mismatched Molecules Generate Chiral "Pinwheels"

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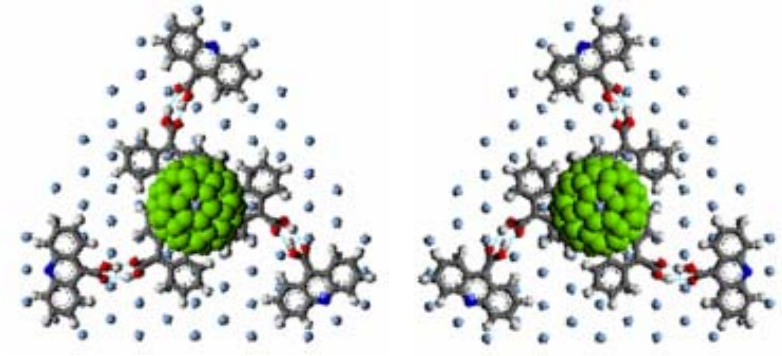
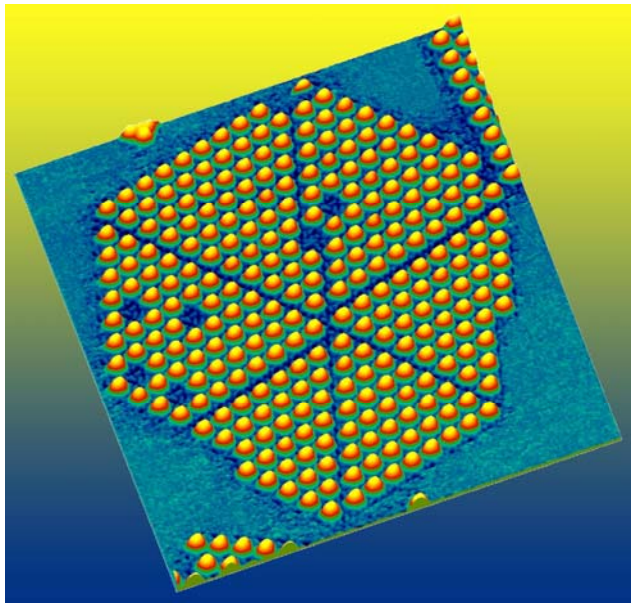
The synthesis of enatiomerically pure structures is an important challenge in pharmaceuticals and for opto-electronic materials. Here we demonstrate how achiral components, by virtue of strong interactions but different base symmetry, can form enatiomerically pure 2-dimensional crystals. The components are C_{60}, a nearly spherical moelcule, and ACA, a rectangular molecule with polar edges. The match between the sphere and the rectangles generates a molecular pinwheel structure with chiral character. The polar interactions among the molecules stabilize formation of enatiomerically pure ordered crystals of the chiral pinwheels





Spontaneous Symmetry

Top right: The molecular components, C60 (green) and Acridine-9-carboxylic acid (ACA, gray) form molecular complexes of 6 ACA and one C60 with an optically active pinwheel structure.

Bottom right: STM image of a an enatiopure domain-network of the self- assembled pinwheel structure. The distance between near-neighbor C_{60} molecules is 2.65 nm. Both the long range order within the crystal and the straight, symmetric domain boundaries are stabilized by hydrogen bonding between the ACA molecules.