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TECHNOLOGY TRANSFER OFFICE

3D Porous Chiral Structures by Self-Assembly of Helical Nanofilaments

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Background

Porous materials are widely used in the chemical industry as catalysts and catalyst supports for chemical reactions or as templates for materials fabrication. Nanoconfined systems prepared using these porous materials are also of rich fundamental scientific interest, with new physics resulting from material's finite-size effects, varying dimensionality, and unique surface forces. Conventional nanoporous materials have regular, crystalline, or amorphous pore structures, such as aluminosilicates and aluminophosphates. Among these, porous structures with chiral molecular frameworks are important in enantioselective separation and catalysis. However, no porous structure with a chiral surface that is able to perform enantioselective separations has been developed so far, leaving further innovation in the present art to be desired.

Technology

Researchers at the University of Colorado led by Noel Clark have developed a method to synthesize 3D porous chiral structures using the self-assembly of helical nanofilaments as a liquid crystal template. The B4 bent-core phase molecules are able to self-organize into layered smectic liquid crystal phase in which there is a strong inherent tendency to form a macroscopically chiral surface. As of now, this system is the first compound made of bent-core liquid crystal molecules to be reported.

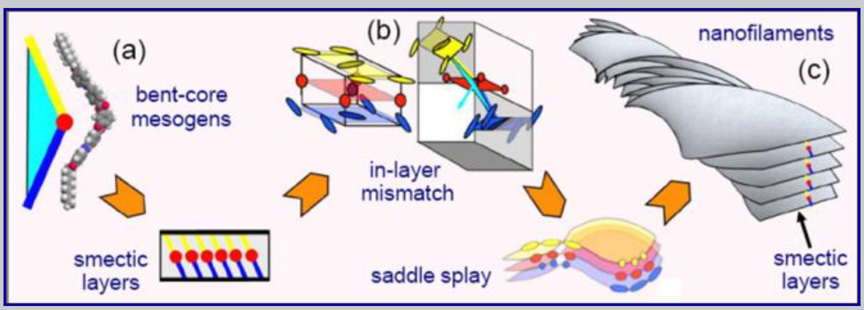

Figure: (a) The hierarchical self-assembly of the nanofilament phase starts with bent-core mesogenic molecules, which form well-defined smectic layers with in-plane hexatic order, macroscopic polarization, and tilt of the molecular planes, making them chiral. (b) In this geometry, the half-molecular tilt directions on either side of the layer mid-plane are nearly orthogonal. The projections onto the layer mid-plane of the lattices formed by the core arms (yellow and violet) do not match, resulting in a local preference for saddle-splay layer curvature and driving the formation of twisted nanofilaments (c).

Key Documents

"Nanoconfined Systems Prepared by Helical Nanofilament Network of Bent-Core Liquid Crystal." Provisional patent application filed February 17, 2012. *Available under CDA.*

Nanoconfinement of guest materials by helical nanofilament networks of bent-core mesogens. Forthcoming: Soft Matter, 2013,9, 462-471. *Manuscript available under CDA.*