TECHNOLOGY

General Synthesis and Assembly of Inorganic Chiral Nanostructures with Tunable Chirality

OVERVIEW

Background

Chirality (or handedness) is the property of an object to be non-superimposable to its mirror image. Right and left hands, for example, are composed of the same components but are distinguishable from each other. Chiral chemical compounds, by extension are composed of the same elements in the same proportions but are distinguishable from each other not only in structure, but in the case of pharmaceuticals, their biological effects. (Thalidomide is a cautionary example of chirality where one stereoisomer of the drug prevented morning sickness while the other was teratogenic.) While chirality in biology and organic chemistry is well known, chirality in the field of inorganic synthesis has been challenging to demonstrate and exploit.

Inorganic nanostructures are an emerging class of nanostructures that are grown from a bottom up approach and fine use in semiconductors and optoelectronic components. Cooperative chirality is the interplay between different chiralities (e.g. atomic chirality and morphological chirality) manifesting at the different length scale in a single structure. Final chiral inorganic structures can be predetermined if the cooperative chirality between chiral units can be controlled independently. However it has been a challenge in inorganic systems to determine cooperative chirality and synthetically control the lattice and geometric chiral parameters at different length scales. If this can be achieved, then chiral inorganic products can be engineered with desired chemical and physical properties.

Invention:

Researchers from the University of Maryland have developed a synthetic scheme to achieve independent and simultaneous control of both lattice and geometric chirality in an inorganic nanostructure. The method consists of a two-step process that applies chiral molecular modifiers to regulate the morphology during the epitaxial growth phase at the atomic scale. The experimental results are supported by computational simulations. The features of this technology allow for the control of cooperative chirality of inorganic structures at different length scales which in turn allows for the engineering of desired physical and chemical properties of the inorganic final product. These as-synthesized inorganic chiral nanostructures can also be used as building blocks for bottom-up self-assembly to form various chiral assembly.

Advantages

· Efficient engineering of desired chiral inorganic products
· Synthetic scheme is universal for many inorganic systems
· Achievable in all length scales from nanostructures to large scale meta structures

Applications

· Engineering of meta devices
· Semiconductors
· Optics and Optoelectronic components
· Synthesis of inorganic chiral catalysts

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Additional Information

INSTITUTION

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PATENT STATUS

Pending

EXTERNAL RESOURCES

PS-2017-087