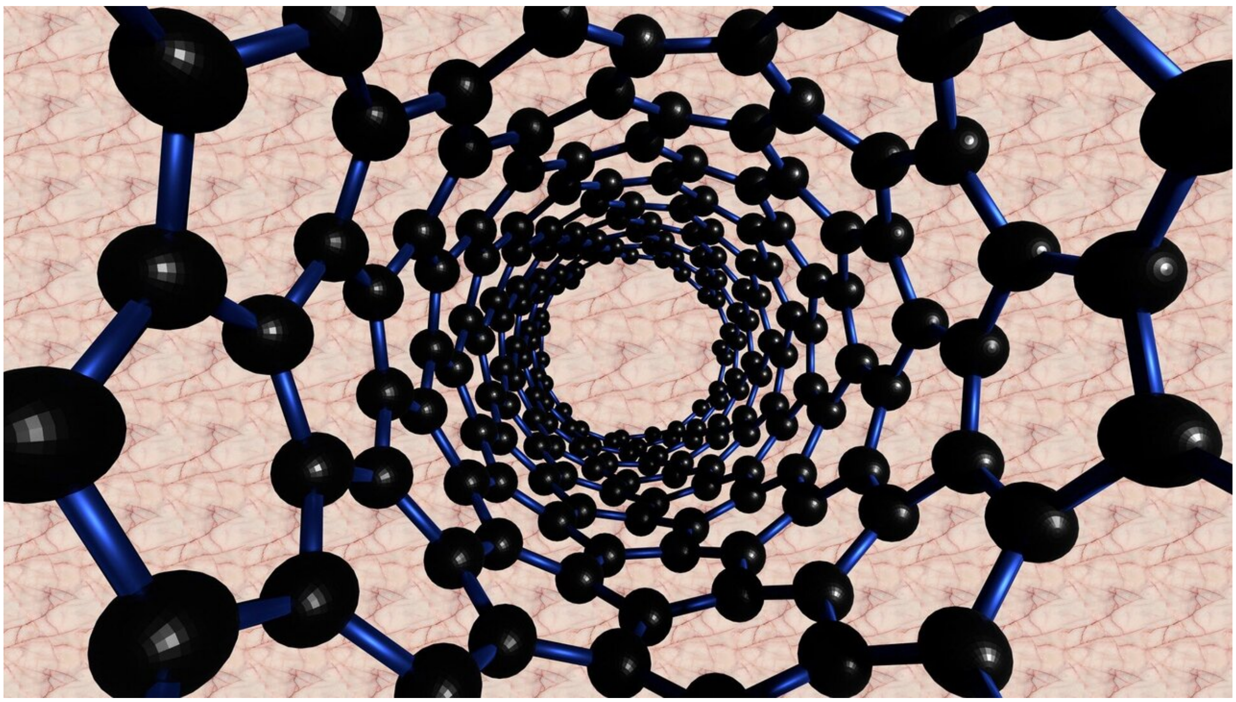
# Emergence of a new heteronanostructure library

May 14 2021



Credit: Pixabay/CC0 Public Domain

Organizing functional objects in a complex, sophisticated architecture at the nanoscale can yield hybrid materials that tremendously outperform their solo objects, offering exciting routes towards a spectrum of applications. Developments in synthetic chemistry over past decades has enabled a library of hybrid nanostructures, such as core-shell, patchy, dimer, and hierarchical/branched ones.

Nevertheless, the material combinations of these non-van der Waals solids are largely limited by the rule of lattice-matched epitaxy.

A research team led by professor Yu Shuhong at the University of Science and Technology of China (USTC) has reported a new class of heteronanostructures they term axial superlattice nanowires (ASLNWs), which allow large lattice-mismatch tolerance and thus vast material combinations. The research article entitled "One-Dimensional Superlattice Heterostructure Library" was published in *Journal of the American Chemical Society* on May 12th.

To achieve the predictable, high-precision synthesis of a library of ASLNWs, they designed an axial encoding methodology that enables regiospecificity for chemoselective transformation.

They started from a predesigned, reconfigurable nanoscale framework, and then chemically decoupled the adjacent sub-objects by exploiting the reaction thermodynamics and kinetics. In this way, they achieved a library of nine distinct ASLNWs with in principle numerous geometric derivatives.

By regulating the reaction selectivity, they were capable of on demand programming the compositions, dimensions, crystal phases, interfaces, and periodicity in ASLNWs. Thanks to such high-level control, they finally achieved superior photocatalytic performances using optimized ASLNWs.

The results sheds new lights on creating high-order nanostructures with increased complexity and improved functions, which would show significant impacts on a broad range of applications in solar energy conversion and optoelectronics.

**More information:** Yi Li et al, One-Dimensional Superlattice

Heterostructure Library, *Journal of the American Chemical Society* (2021). DOI: 10.1021/jacs.1c01514

Provided by University of Science and Technology of China