Carbon Nanotubes Gallery

Low-friction Carbon Nanotube Bearing Assembly

Description:
The high tensile strengths and stiffness of carbon nanotubes have made them important as building materials in many current nanoscience applications. Their range of use is expected to extend to molecular manufacturing applications in nanoscale scaffolding and molecular electronics. Their cylindrical shape and highly delocalized electronic structure make them interesting possible choices for the design of molecular bearing assemblies. In the design at left, the cut-away section is a single covalent structure, around which a low-friction diamondoid bearing is kept from finding a highly stable minimum energy position.

Author:
Damian G. Allis
Department of Chemistry, Syracuse University A Carbon Nanotube Molecular Bearing Assembly

Description:
The design of complex nanosystems with numerous moving parts is made complicated by the fundamental limits of chemical bonding and the possible interfaces between moving parts that can be achieved with certain nanostructures. It is possible that this spatial quantization of atomically precise building materials may also be used to drive the self-assembly of some nanosystems, greatly simplifying the assembly process. The nesting of appropriately sized carbon nanotubes, such as shown at left, can serve as a strong driving force for molecular bearing self-assembly.

Author:
Damian G. Allis
Department of Chemistry, Syracuse University Carbon Nanotube Crimp JunctionDescription:
The high tensile strengths of carbon nanotubes make them likely material candidates in future nanoscale manufacturing applications. In the absence of atomically precise manufacturing methods for fabricating continuous scaffoldings of a single nanotube, methods that lock nanotubes into place by strong electrostatic and/or steric approaches may be possible. The diamondoid crimp junction shown at left is a single covalent nanostructure that fixes two nanotubes at right angles.

Author:
Damian G. Allis
Department of Chemistry, Syracuse University Carbon Nanotube 6-way Junction

Description:
The junction at left is generated by three pairs of carbon nanotubes fixed along (x,y,z) axes. The interfaces at the center of this junction are composed of 6 adamantane molecules covalently bound to each carbon nanutobe and functionalized with either nitrogen (N) or boron (B) atoms. These nanotubes are not covalently bound to one another, instead employing dative bonding between nearest-neighbor B-N pairs to hold the six nanotubes in place, a method that offers the possibility of complex structure formation via familiar chemical self-assembly.

Author:
Damian G. Allis
Department of Chemistry, Syracuse University