Fabrication of Molecular Nanosystems Using Boron

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Invention

Chemists have long been involved in the design and synthesis of functionalized molecules with specific structural, chemical, and physical properties. Most of the work currently performed in nanoscale design has focused on carbon as the primary structural element due to the resulting architecture's favorable chemical and physical properties and the general familiarity with the organic compound. However, minimal research has been conducted toward applying boron, and main group and transition metal polyhedral cluster species in general, as potential alternatives to these organic species. This technology describes the use of polyhedral cluster structural subunits called "synthons" in the design and manufacture of molecular macrostructures, machines, and devices.

Technology

U.S. Patent No. 6,531,107

Chemically "prefabricated" subunits are designed with structural features meeting a set of predetermined criteria. The criteria include: requirement for unidirectional chemical synthesis in the construction of larger structures; the use of rigid components with controllable structural, electronic, and chemical properties; the potential for very high yield subunit preparation; and the availability of adjustable chemical and structural parameters which will allow for tailoring of subunit properties. Subunits assemble to form essentially strain-free macrostructures.

Application

Nanomechanical and nanostructural devices and systems

Advantages

Synthon units exhibit:

- Rigid structural frameworks,
- Availability of stereo- and regiochemically directed substitution patterns,
- Synthetic availability and accessibility with substitutional control,
- Extreme chemical and thermal stability,
- Stability to photochemical and neutron irradiation,
- Potential for designing three-dimensional arrays with atomic precision,
- Diversity of structural arrangement, and
- Means of interconnection.

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