Purpose:

Basic research into the structure-property relationships in carbon nanotubes, hydrogen storage materials, novel catalysts and electronic nanomaterials will provide the know-how to design and build energy-efficient devices for manufacturing and transportation.

Sponsor:

U.S. Department of Energy's Office of Basic Energy Sciences

Funding:

$81 million for construction and major equipment

$19 million annually for operations

Features:

- Clean rooms
- General laboratory space
- Wet and dry laboratory space
- Materials-synthesis equipment
- Scanning-probe and surface-characterization facilities
- Electron microscopy facilities
- Spectroscopy facilities
- Lithography-based fabrication facilities
- Office space for users and staff
- Dedicated beam lines at the NSLS

Users:

An estimated 300 annually from academia, industry, and national laboratories

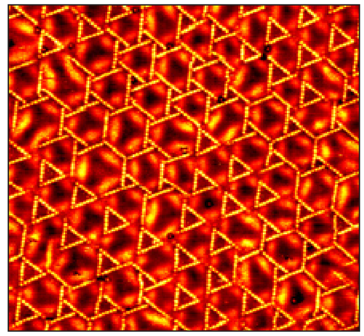
http://www.cfn.bnl.gov

Brookhaven's Center for Functional Nanomaterials

Center for Functional Nanomaterials

Science for Discovery at the Ultrasmall

The Brookhaven Center for Functional Nanomaterials (CFN) will be a hub for cutting-edge nanoscience studies.The scientific goals of the CFN are primarily aligned with addressing our national challenges in energy. Nanostructured materials may enable energy-efficient processes and devices for alternatives to fossil fuels, in the form of efficient catalysts, fuel cells, photovoltaic (solar cell) elements, or solid-state lighting. Research programs in the CFN focus on three key areas:



Nanoscale arrangement: Sulfur atoms form "dancing triangles" on copper.

Nanocatalysis

Nanocatalysis uses tiny structures, a few nanometers (*billionths* of a meter) in dimension, to speed up chemical reactions essential to modern life. Metal-containing nano-particles are indispensible ingredients in industrial chemical production and energy-related processes.

For instance, fuel cells for powering electric vehicles use bi-metallic particles of platinum and ruthenium to catalyze the conversion of chemical energy into stored electrical energy. These particles are less than 100 nanometers in size and make up only a few percent of the catalyst's weight, yet they provide the active sites where chemical reactions take place. CFN scientists are now developing new experimental and theoretical tools to image and understand chemical reactions activated by such nanoparticles.

Biological and soft nanomaterials

Soft nanomaterials include polymers, liquid crystals, and other relatively "squishy" materials that fall into a state between solid and liquid, whose properties can be engineered to replicate those of conventional "hard" materials, yet are lighter, transparent, cheaper, and, in some cases, biocompatible.

Of current interest is the development of methods that mimic Nature to assemble hybrid nanosystems that combine inorganic and biological components that maintain biofunctionality. Such nano-engineered systems will find applications in advanced optical, magnetic, and electrical devices that require placing nanoobjects with high precision.

CFN scientists are investigating ways to biofunctionalize nanoparticles and nanotubes with DNA and proteins; developing methods to use biomolecules as scaffolds, or "guides," to build two- or three-dimensional arrays of organized nanoobjects; and exploring how cooperative effects among those objects can be exploited in applications.

Electronic nanomaterials

At the nanoscale, materials can exhibit electrical and optical characteristics that are not present when they have macroscopic dimensions. For instance, electronic mobility is enhanced drastically in certain nanomaterials, and, in others, the emission or absorption of light is improved significantly. These novel properties give electronic nanomaterials the potential for strongly impacting the performance of energy-conversion devices.

The CFN program emphasizes the preparation of nanomaterials and understanding their optoelectronic properties to create both individual nanostructures and organized assemblies. Developing nanomaterial assemblies is important, for example, for use in large-area energy conversion devices.

(05-07)