Center for Functional Nanomaterials

Science for Discovery at the Nanoscale

Purpose:
To facilitate the research objectives of the nanoscience community and to advance the science and technology of nanomaterials to address the nation's energy challenges.

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

Facilities & Capabilities:

- Thin film nanofabrication and processing capabilities within a 5000 ft^2, Class 100/1000 clean-room facility
- High resolution electron-beam and nano-imprint lithography
- Organic and inorganic nanomaterials synthesis and characterization
- Scanning-probe and surface-characterization facilities
- Electron microscopy facilities
- UV, visible, and infrared advanced optics methods, down to single molecular levels
- Time resolved absorption and emission spectroscopy
- Theory and diverse software packages for quantum chemistry and materials calculations with a supporting computer cluster
- Thin film processing, including deposition and plasma etch systems
- Dedicated x-ray beam lines at the NSLS and NSLS-II

Users:
Over 350 users annually from academia, industry, and government laboratories

http://www.bnl.gov/cfn

The Center for Functional Nanomaterials at Brookhaven Lab

The Center for Functional Nanomaterials (CFN) at Brookhaven National Laboratory is an internationally recognized, user-oriented research facility. Its dual mission is to serve as an open facility for the nanoscience and nanotechnology research communities and to advance the science and technology of nanomaterials that address the nation's energy challenges. External users of the CFN investigate diverse research topics, such as efficient catalysts, fuel cell chemistries and architectures, and photovoltaic (solar cell) components. Internal research programs at the CFN focus on three experimental and theoretical areas:

Investigators come from around the world to use the CFN's state-of-the-art facilities and capabilities in conducting their nanoscience and nanotechnology research.

Interface science for nanocatalysis

Nanocatalysis uses tiny structures, a few nanometers (*billionths* of a meter) in dimension, to accelerate chemical reactions that are essential to modern life. Metal-containing nanoparticles are indispensable ingredients in industrial chemical production and energy-related processes.

The rational design of nanoscale catalysts for the efficient conversion, storage, and consumption of energy depends on understanding interfacial phenomena that control catalytic chemistry. CFN scientists and engineers synthesize model nanocatalysts and use advanced in-situ microscopy, spectroscopy, and theoretical calculations to investigate how these nanoparticles behave under realistic reaction conditions, the results of which will help determine their potential as future catalysts.

Soft and biological nanomaterials

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

CFN scientists and engineers are exploring novel techniques to assemble inorganic, organic, and biological components in nanomaterials with tailored functionalities — for example, to modulate the properties of light and to regulate energy transfer at the nanoscale.

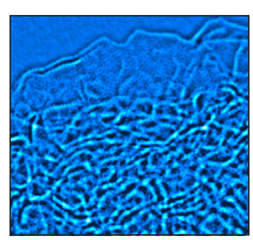
In particular, biomolecules such as DNA or proteins are used to construct two-dimensional and three-dimensional arrays of organized nanomaterials. These studies can reveal how cooperative effects among the components of the array can be exploited in a variety of energy-related applications.

Electronic nanomaterials

At the nanoscale, a number of materials exhibit novel electrical and optical properties, some of which can be particularly useful for the efficient harvesting and conversion of solar energy into other usable forms, like electricity.

CFN scientists and engineers are exploiting those properties to achieve new insights into the production of more efficient photovoltaic devices, such as organic solar cells based on nanomaterials, and for other energy-related applications, such as high-density energy storage systems and efficient photocatalysts.

Atomic resolution electron micrograph of activated graphene, which acts like a super-absorbent sponge when it comes to soaking up electric charge.



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