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**DIVISION OF CHEMICAL AND TRANSPORT SYSTEMS  
DIRECTORATE FOR ENGINEERING  
NATIONAL SCIENCE FOUNDATION**

**STRATEGIC PLAN  
MAY 31, 2005**

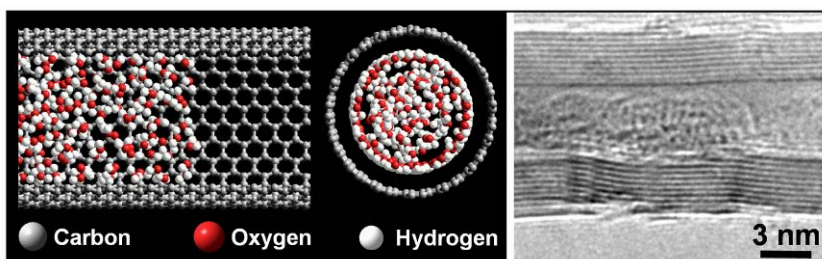
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nanostructured materials for environmental remediation applications, and studies of health-related issues involving nanomaterials.

In order to accelerate the benefits to society from targeted investments in fundamental research on the above topics, CTS will allocate funds to support research addressing fundamental questions underlying the scale-up of the synthesis processes, development of new instrumentation and nanometrology, chemical- and bio-sensor related research, synthesis of nanomaterials with unique physical and chemical properties, as well as new approaches for materials processing and characterization at the nanoscale. The results of these research projects will also find applications in fields of science and engineering.



Carbon nanotubes are extremely nano-scale hollow tubes fabricated by assembly of carbon atoms into tube-like structures. Such small tubes can be used to transport a liquid, just as a large pipe can convey liquid water or natural gas, from place to place. This study of fluid flow at such small scales is termed "nanofluidics." Left and middle images: HyperChem simulation of water molecules in a (15, 15) carbon nanotube. Right image: TEM observation of water in a carbon nanotube with an inner diameter of 4 nm. (Gogotsi, Bradley, Megaridis, and Bau; Drexel University, University of Illinois, Chicago, University of Pennsylvania ).

## **SAFETY AND SECURITY (SS)**

CTS activities in safety and security, including physical and cyber infrastructure, are directed at assisting the development of improved, long-range homeland security technologies as well as addressing industrial safety and security issues. Safety involves a systems approach integrating detection, analysis, validation and decision making into a proactive prevention process. CTS research focuses on fast, accurate, non-intrusive detection and sensing methods for chemical, thermal and biological events and process control and prevention strategies. Another aspect of safety and security is the reduction of US dependence on imported fossil fuels through research in alternate energy technologies such as bio-based fuels and more environmentally benign recovery and use of domestic fossil fuels resources. Processes for efficiently producing, storing and converting hydrogen are also of growing interest to CTS to help develop improved national economic security. The prevention of industrial accidents, to insure that there are no repeats of incidents like the chemical spills in Bhopal, India are also of priority to CTS.

Some specific priority topics for additional future support include:

- Flow and mixing of cohesive powders is a CTS research topic of great interest to the pharmaceutical, chemical and petrochemical industry, and also has application in natural phenomena such as landslides and avalanches.
- Understanding the physics and chemistry of fire spread will enable better fire safety in the face of terrorist attacks or other unplanned fires.
- A fundamental understanding of the underlying mechanisms will enable process design and optimization of industrial processes and prediction and mitigation of related natural hazards.
- Chemical process design for enhanced plant security is an important aspect of homeland security since the potential for severe environmental and economic consequences is substantial.