Overview of the Organization

The specific research objectives of the Center are:

• to optimize the synthesis, purification, and separation of specific SWNT for specific applications
• to develop smart SWNT films that can interact with light and molecules in a predictable way for sensor and biosensor applications
• to develop novel SWNT-metal composites with improved mechanical, thermal, and electrical properties
• to investigate the interactions between SWNT and living cells for development of diagnostic techniques and explore potential health effects

CANTEC contributes significantly in areas such as materials science, chemical science, biological and environmental science, advanced computer science, energy efficiency, and renewable energy science.

The research team includes experts in the fields of catalysis, carbon nanotubes, surfactants, materials science, sensors, biosensors, biological systems, and numerical simulations. The research labs in three different departments are well equipped with state-of-the-art facilities to produce, test, and characterize SWNT of high quality and in large scale; as well as to develop and characterize composites, optoelectronic devices, sensors, and electrochemical and biological systems for the proposed applications.

Recent Highlights

The different research groups made important advances in the areas of synthesis and application of Single-Walled Carbon Nanotubes and as a result the group has made several oral presentations and it has submitted articles for publication.

We have been working in these projects during 2011:

• Study of the growth of conductive single-wall carbon nanotube films with ultra-high transparency
• Heat transfer in high volume fraction CNT nanocomposites: effects of inter-nanotube thermal resistance.
• Effective heat transfer properties of graphene sheet nanocomposites and comparison to carbon nanotube nanocomposites
• Role of Surfactant Molecular Structure on Self Assembly: Aqueous SDBS On Carbon Nanotubes
• Simulation Insights on Thermally Conductive Graphene-Based Nanocomposites
• Vascular targeted single-walled carbon nanotubes for near-infrared light therapy of cancer.”
• Stabilization of Aqueous Carbon Nanotube Dispersions Using Surfactants: Insights from Molecular Dynamics Simulations
• Non-covalent Attachment of Proteins to Single-Walled Carbon Nanotubes
• Raman Intensity Measurements of Single-Walled Carbon Nanotube Suspensions as a Quantitative Technique to Assess Purity
• Determination of the Metallic/Semiconducting Ratio in Bulk Single-Wall Carbon Nanotube Samples by Cobalt Porphyrin Probe Electron Paramagnetic Resonance Spectroscopy
• Carbon Nanotube Integration with a CMOS Process
• Anchoring Pd Nanoclusters onto Pristine and Functionalized Single-Walled Carbon Nanotubes.
• Solid Nanoparticles that Catalyze Biofuel Upgrade Reactions at the Water/Oil Interface.
• Morphology effects on non-isotropic thermal conduction of aligned single- and multi-walled carbon nanotubes in polymer nanocomposites

Activities Planned for 2012

• Lithium/CNT electrodes for high-current high-durability applications for applications in Hybrid cars: increase electri-
cal and ionic conductivity by intercalating LiMnPO₄ nanoparticles with carbon nanotubes of precisely controlled structure.

- **Supported Metal Nanoparticles: Selective Heterogeneous Catalysts**: prediction of the absorption energy and vibration frequency of CO absorbed onto the active sites identified on the nanoparticles surfaces.
- **Electrospinning of Redox Polymer-SWNT Nanofibers for Biosensor Applications**: develop an innovative near-field electrospinning manufacturing process to spatially pattern redox polymer-SWNT nanofibers, to characterize the physical and chemical properties of the nanofibers, and to develop deposition techniques to attach variable loadings of redox enzymes to the nanofibers.
- **Targeted Single-Walled Carbon Nanotubes for Cancer Therapy Using Near-infrared light or radiofrequency field**: we will study the effectiveness of the photodynamic therapy with NIR light we have developed and on using a radiofrequency field instead of NIR light to heat the SWNTs.
- **Understanding and improving thermal properties of CNT composites**: investigate computationally the thermal properties of carbon nanotube composites and suspensions and to explore the design of materials that can have tunable thermal properties.
- **Nanocomposites made from Specialty Multiwall Carbon Nanotubes**: This project will continue our ongoing collaboration with our local manufacturer of carbon nanotubes, SouthWest NanoTechnologies. We will study the behavior of specialty multiwall carbon nanotubes in polymer composites.
- **Carbon Nanotube Gas Diffusion Layer for Hydrogen Fuel Cells**: the goal is to advance the knowledge of carbon nanotube gas diffusion layer on the performance of the fuel cell.
- **Design of micro-heat exchangers utilizing CNT forests**: design of appropriate configurations of CNT forests that can be used to dissipate heat from micro-chips.

**Recent Publications and Presentations**


**Linkages and Partnerships**

- The University of Oklahoma (OU) has a technological advantage in the production of SWNT, via the use of a proprietary catalyst and a truly scalable production process (6 key patents issued, strong position in the IP field). Based on this novel technology, an OU startup company (South-West Nanotechnologies, SWeNT http://swentnano.com/) is developing a large-scale process (CoMoCat®) that will greatly increase the availability of SWNT of the highest quality.
- Funding for this Center comes from DoE, OCAST (Oklahoma Center for the Advancement of Sci. and Tech.) and has supported research on applications of single-walled carbon nanotubes (SWNT) that are produced in large scale by our unique method (CoMoCat®)

**Impacts and Outcomes of CaNTec**

Commercialization of nanotube-based products has an impact on many economic sectors. Lighter, stronger materials will result in more energy efficient transportation without compromising safety. Improved heat transfer materials and electrical conductors will improve the efficiency of power generation and transmission, resulting in lower energy costs and improved manufacturing efficiency, which will result in economic growth. Improved sensors and medical diagnostics tools will improve environmental quality and health care.

100 East Boyd St.  
Norman, OK 73019  
(405) 325-4370  
Director - Dr. Daniel Resasco  
resasco@ou.edu  
http://www.ou.edu/engineering/nanotube