Chirality Dependent Carbon Nanotube Separation for Lightweight Electronics

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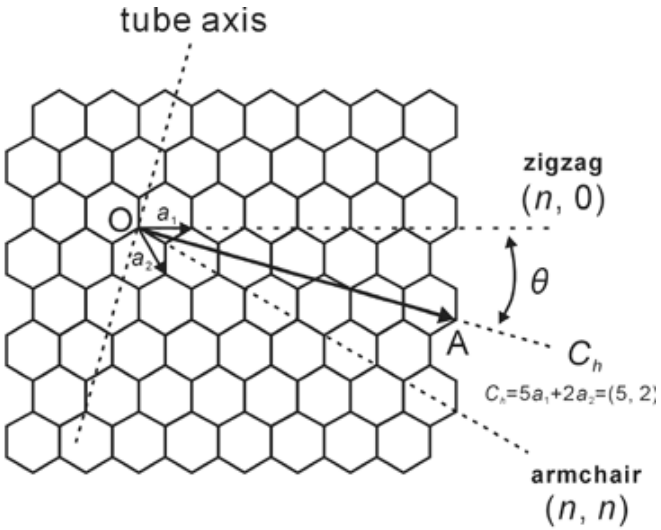
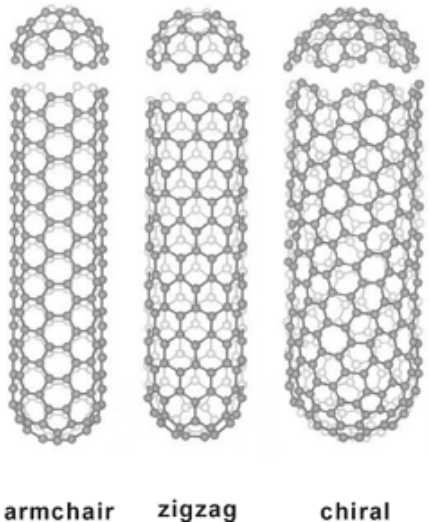
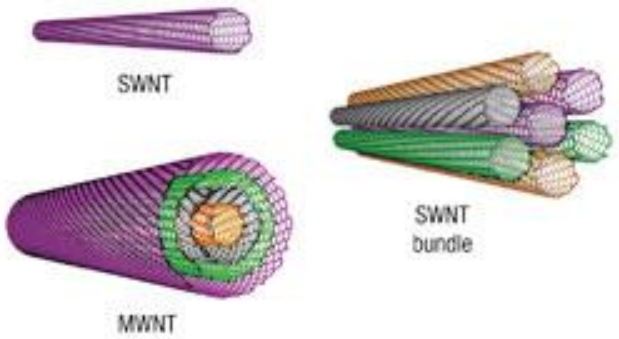
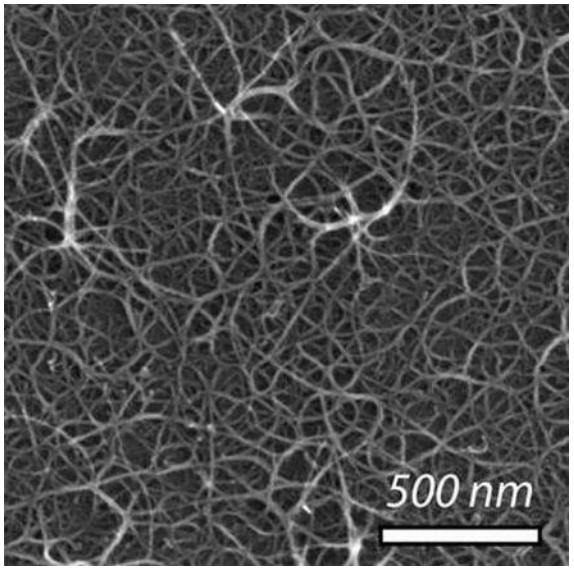




- Carbon nanotube samples have various tubular configurations.
- SWNTs also form bundles due to strong π-π interactions.
- All of the production methods for SWNTs yield mixture of metallic and semiconducting nanotubes.
- Chirality specific SWNTs are needed if these promising materials are aimed to be used in technological applications.
- Separation techniques;
  - ✓ Surfactant assisted dispersion
  - ✓ Density gradient ultracentrifugation
  - ✓ Polymer wrapping
  - ✓ Interactions with polyaromatic hydrocarbons





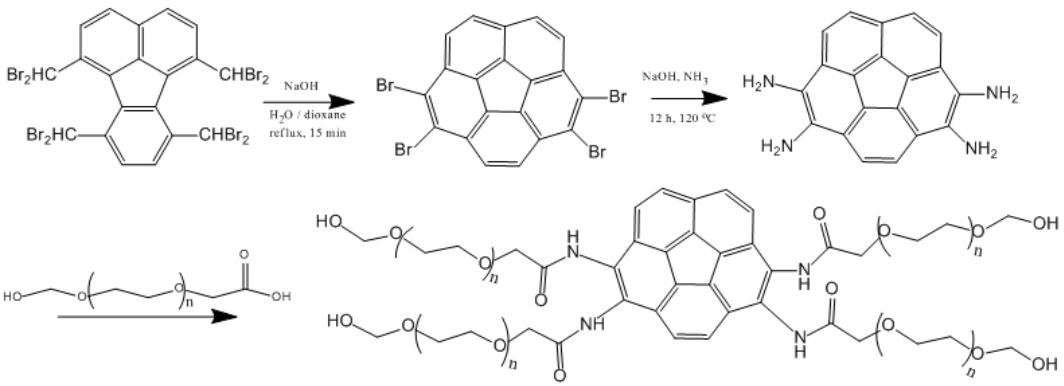
Relevance to NASA

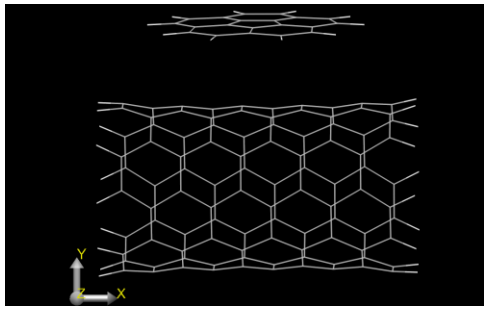
- Proposed research overlaps with the RFAs such as **Small Satellite Research, Development, and Construction**, **Materials Science Research**, and **Planetary Space Suit Research**.
- Single-walled carbon nanotubes are 50-100 times stronger than steel at a sixth the weight.

- Possible projects would be related to life-support systems, including gas and water purification.
- Biomedical applications for human spaceflight are also of interest.
- Other possible projects include energy storage, thermal protection, structural or multifunctional materials, or sensors.
- Regarding power components and materials, emphasis is placed on the development of high-temperature, high frequency, high power density, radiation-resistant semiconductors, switches, diodes, carbon nanotube conductors, magnetics and capacitors, and advanced thermal management techniques for the build-up of power converters and power distribution units.

Material	Young's modulus (GPa)	Tensile Strength (GPa)	Density (g/cm^3)
Single wall nanotube	1054	150	1.4
Multi wall nanotube	1200	150	2.6
Diamond	600	130	3.5
Kevlar	186	3.6	7.8
Steel	208	1.0	7.8
Wood	16	0.008	0.6

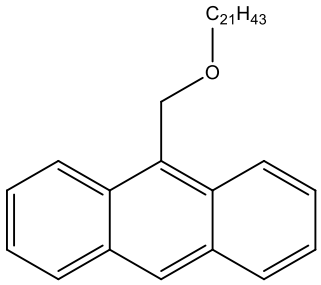
Synthesis of Novel Dispersants

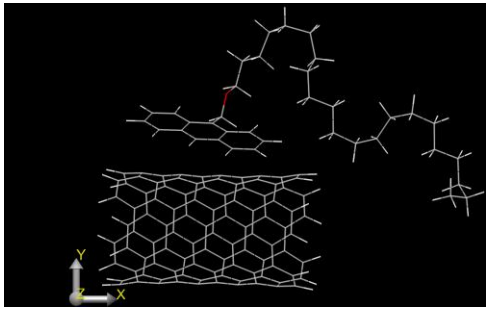


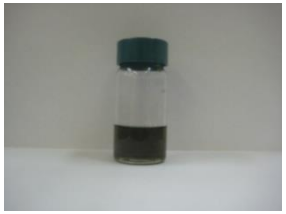


PEGylated Corannulene Synthesis

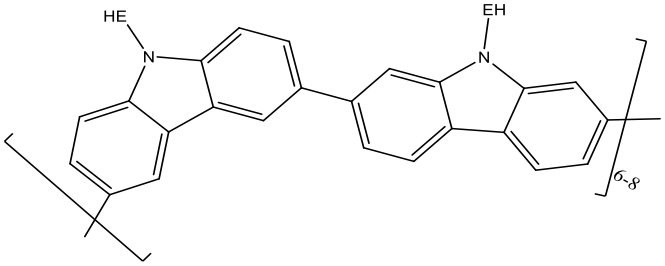
Anthracene Derivative

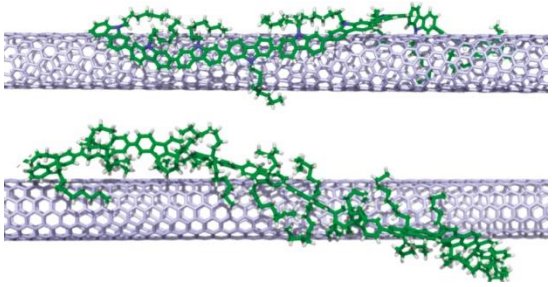


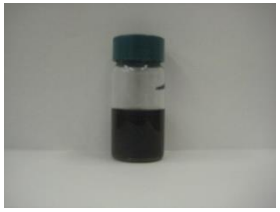




Polycarbazole Oligomers







Collaborations and Student Involvement

- We collaborate with Dr. Bin Chen from Advanced Studies Laboratories at NASA Ames Research Center.
- His research is focused on composite materials with complementary properties from polymer and inorganic nanostructures that increase the material mechanical strength, thermal conductivity, electric conductivity, and high-Z radiation shielding power.
- Applications include (1) control and structural components for deployable structure and habitat in space; (2) high throughput fuel cell anode, cathode, and electrolyte materials; (3) flexible solar cell with power output reaching to 200 kW/kg; and (4) radiation material with full spectrum stopping power and minimum secondary ions.
- Baris Yilmaz was hired as a graduate student to conduct the relevant research.
- Three publications in the horizon.

Future Plans

- Publication of recent results.
- Demonstrate feasibility of CNTs for applications as Transparent Electrodes in solar cell research.
- Collaboration with Dr. Bin Chen at AMES (joint experiments and proposal preparation)
- Planning to submit a pull proposal to National Science Foundation (DMR division) within a year.
- Proposal Coordinating Office at NASA Ames Research Center (will discuss this with our collaborator)
- NASA Headquarters for the call “Fellowships for Early Career Researchers”.
- Air Force?