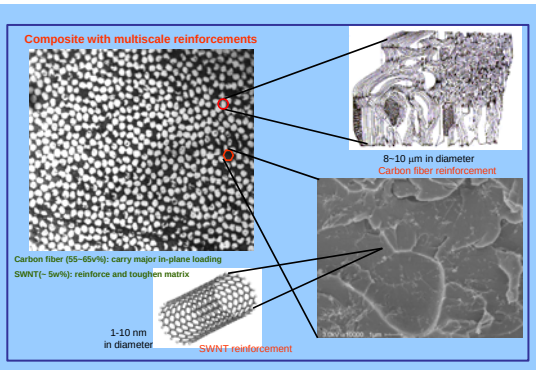
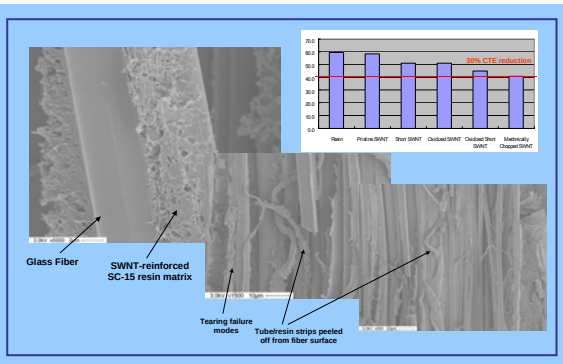
Synopsis:
Nanotube/Carbon Fiber Multiscale Reinforcement for High-Performance Composites



Multiscale reinforcement composites



CTE tailoring and new failure modes

Background

Using nanotubes in fiber-reinforced structural composites provides the potential for improving resin-dominated properties such as interlaminate strength, toughness, and thermal and environmental durability. Several thousand times smaller than carbon or glass fibers, single-walled nanotubes (SWNTs) can be used as reinforcement materials between fibers and laminas in conventional structural composites. HPMI is improving conventional fiber-reinforced composites by adding small quantities (0.5 ~ 5 w/w%) of nanotube materials to the resin matrix during the composite manufacturing process, achieving the benefits of nanocomposites at a fraction of the cost.

Goals

- Develop affordable functionalization and dispersion techniques to uniformly disperse nanotubes in resin matrix
- Understand the effects of tube/resin and tube/fiber interactions on resin-dominated properties in fiber-reinforced composites
- Reveal processing-nanostructure-property relationships in nanotube/fiber multiscale reinforcement composite materials

Project/Research Highlights

- Functionalize SWNTs to enhance tube dispersion and interfacial bonding
- Tailor and optimize viscosity of nanotube/resin mixtures for the applications in conventional composite processes by using selected dispersion agents and surfactants, as well as tube surface treatment
- Reveal and model new failure modes and mechanisms in the multiscale reinforcement composites
- Characterize and demonstrate comprehensive properties of the multiscale reinforcement composites

Benefits to Industry

- Enhance the performance of fiber-reinforced composites at a limited cost increase and with only minor changes in processing techniques
- Provide electrical and thermal conductivity improvements in composites at a more affordable price