Carbon Nanotube Buckypaper/Thermoplastic Composites: Synthesis and Nanostructure-Property Relationship Study

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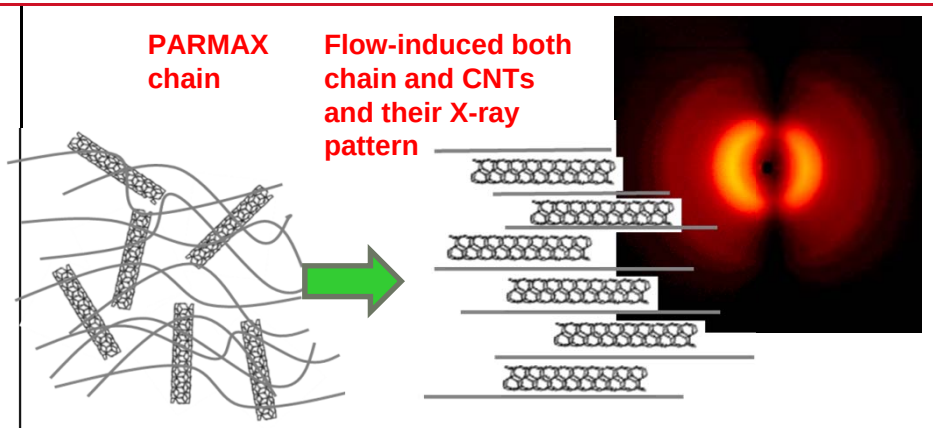
Objective:

Explore and demonstrate enabling synthesis methods and advance fundamental understanding of long molecular chains/CNT interactions to realize high-performance and multifunctional nanotube thermoplastic resin-based composites with high mechanical and electrical performance, improved thermal stability and low moisture absorption properties for potential Navy and DoD applications



Approach:

- Use buckypaper materials of high CNT concentration and high degree of alignment to realize a substantial increase in thermoplastic (TP) resin composite performances;
- Study enabling synthesis methods for using high-performance thermoplastic Polyphenylene (PARMAX or SprimoSpire) and in-situ polymerization of cyclic monomers to fabricate high-concentration nanocomposites (>30wt.%);
- Explore interactions of long TP molecular chains and CNTs and interface formation mechanisms through modeling and HRTEM analysis; and
- Study failure modes and reveal structure-property relationships of high-resilient CNT/TP composites.

Impact:

- Revealed the negative effects of high CNT concentrations on CBP in-situ polymerization possibly due to strong interactions between CNT surface and monomers

Activities & Accomplishments:

- Demonstrated significantly enhanced flow-induced alignment of both liquid crystalline polymer chains and CNTs and substantial increase in composite performance thorough the dual alignment effect to potentially optimizing CNT/TP composite properties;
- Fabricate 14“ x 14“ panel samples for EMI shielding and lightning strike protection tests.

Publications:

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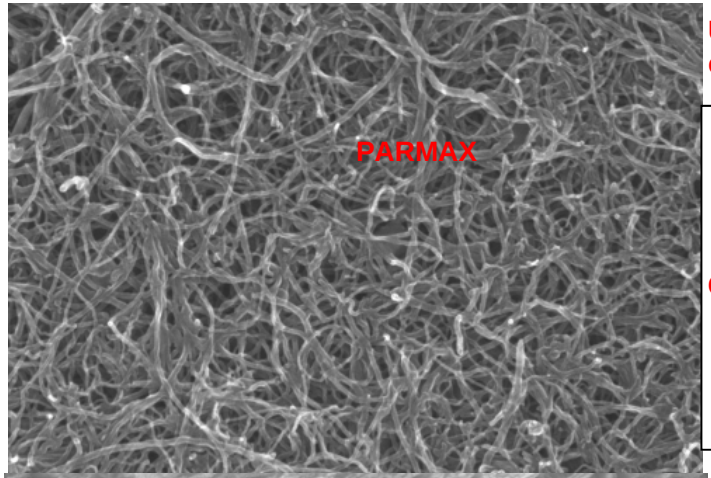
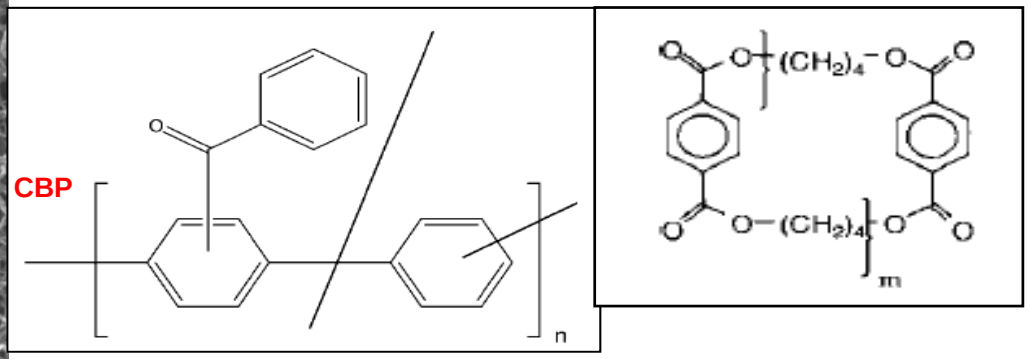
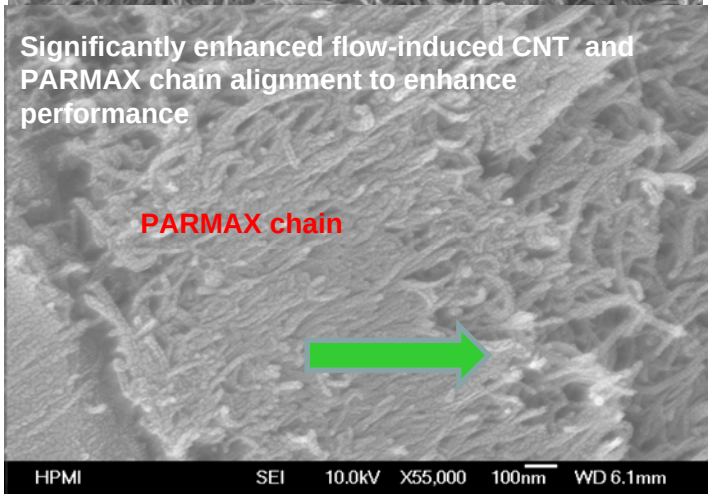


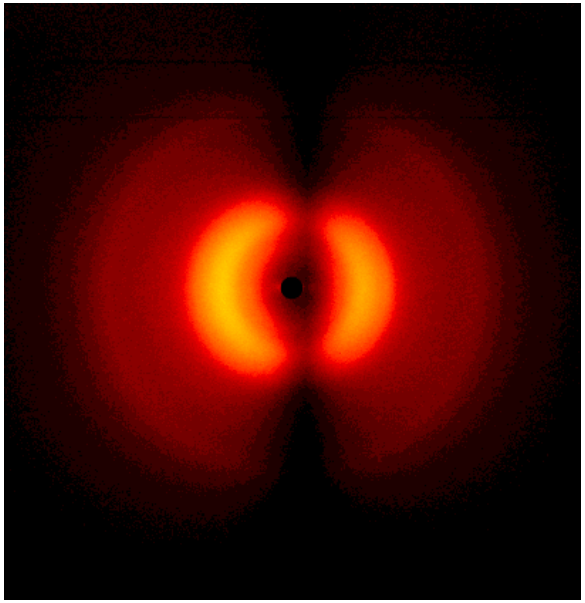
Uniform dispersion and long MWNTs in buckypaper to enhance sample quality and CNT/chain interactions

CBP





PARMAX provides the highest mechanical properties and outstanding thermal stability among TP resins; CBP resin is selected for viscosity and in-situ polymerization to realize high CNT concentrations



Flow-induced both chain and CNTs and their X-ray pattern