

Structural Boron Nitride Nanotube Composite Development

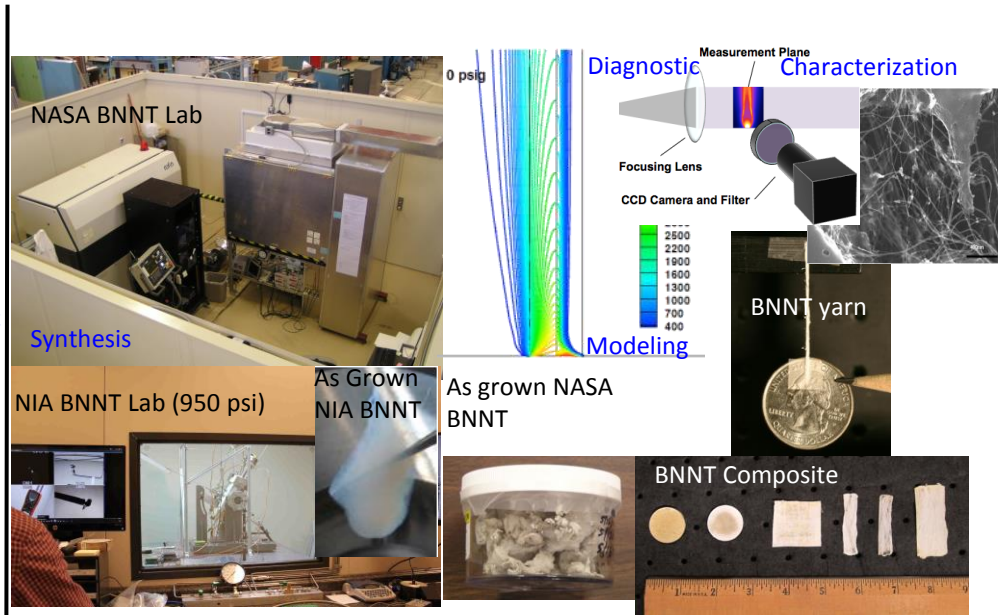
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Overview:

Introduction: Our novel high pressure, high temperature synthesis method produces white, highly crystalline, small diameter, long BNNTs without any catalyst. The quality of BNNTs will be optimized by understanding the nucleation and growth mechanism of BNNT through coherent computational modeling and *in-situ* and *ex-situ* experiments. Both BNNT production and science rigs operational.

Goals and Objectives: Produce high quality, large quantity BNNTs and BNNT fibers for use as reinforcements for polymer, ceramic, and metallic matrices and assess the scale-ability of existing synthesis methods for large scale production of these reinforcements.

Deliverable: High quality optimized BNNT synthesis method and systematic property database of BNNT composites. Fabrication and analysis of non-woven mats, fibers, yarns and composites to evaluate their structural and functional properties.



Status/Accomplishments:

- **Results:** Daily operation of BNNT synthesis enables purification, dispersion, BNNT mat/yarn formation, extend BNNT research to collaborators (9 grams).
- 3 different purification methods employed for impurity removal; 20+ different solvents and co-solvents evaluated.
- 100+ BNNT coupons fabricated from various polymer composites with up to 75 wt% BNNT; mechanical testing underway
- Continuous fiber spinning process of BNNT-polyamide nanocomposite fibers via *in-situ* interfacial polymerization for simultaneous structural alignment.
- Advanced *in-situ* optical diagnostics: verified up to 950 psi/1000°C with a new NIA BNNT science chamber (current rig max pressure is 200 psi)

Collaborators & Roles:

Industry/University/Government: BNNT, LLC, AFOSR, Rice University, SUNY-Binghamton, UNH, Momentive, NIST, Berkeley

NASA Centers: ARC, GRC, JSC, GSFC

Products (IP, publications, S/W):

IP: 5 patents

Publications: 10

Next Steps

- Continue production of BNNTs to enable the further fabrication of structural BNNT composites.
- Through modeling and diagnostics verify and define the current environment for BNNT growth.
- Modify parameters and conditions to optimize growth environment and production.
- Further produce and evaluate BNNT containing structural components to compare to state of the art materials.
- Produce sufficient structural data for a demonstration opportunity.
- Transfer BNNT to collaborators through MTA to increase no cost data generation and expand material property database.