# ABSTRACT

After the discovery of carbon nanotubes, boron nitride nanotubes were first theoretically predicted and successfully synthesized in 1995 by an arc-discharge method. Following that, other techniques for BNNT synthesis were discovered; however, growing highly purified BNNTs remains difficult. The research on the physical properties of BNNTs shows that they have a stable broad band gap, excellent mechanical strength, high thermal conductivity, and high oxidation resistance. These properties make them a perfect candidate for future nanocomposites for high-temperature applications. Interesting effects of BNNT addition with the resultant mechanical behavior and thermal conductivity in a matrix are observed when BNNTs are applied to form nanocomposites with polymer, metal, and ceramic matrices. Modeling and simulation methods of nanotube composites are highly advantageous in developing BNNT-based nanocomposites.

This report presents a Ph.D. dissertation for assessing and developing multifunctional BNNT composites applicable in space or high-temperature composite structures. The report will cover the critical elements accomplished, focusing on the decomposition and high-temperature stability of BNNTs, high-precision polymer and ceramic SLA 3D-printed BNNT composites, hybrid composites, and nanotube composite modeling techniques.