

Carbon Nanotube Yarns and Sheets for Structural Components

Supporting/Contributing Agency: National Reconnaissance Office

Conductive wiring Research programs with Nanocomp Technologies (Concord, NH) leverage its proprietary advancements in the production of millimeter long carbon nanotubes together with a unique ability to fabricate them into conductive yarns and sheets. The government's R&D focuses on creating products with revolutionary performance benefits, creating a new generation of extremely lightweight and highly conductive wiring.

Carbon nanotube material properties hold great promise for structural components where a revolutionary advantage is achieved through the exploitation of its light weight and strength. Table 1 shows current noteworthy achievements. Ongoing R&D for structural components is tailoring the CNT yarns and sheets strength, toughness and conductivity for specific missions.

Table 1. Current State of CNT Yarns and Sheets R&D

Property	Current Achievement	Relevance
Strength – Spun Yarns	3 GPa 1.5 Nt/Tex or 450,000 psi	With fracture toughness higher than aramids (e.g., Kevlar® or Twaron®).
Strength – Sheets	Breaking strengths: without binders, that range from 500 MPa to 1.2 GPa depending upon tube orientation	Aluminum breaks at 500 MPa, carbon steel breaks around 1 GPa.
Weight	Less than half the weight of aluminum	Quickly addresses platform weight issues

The Figures below show the state of readiness for use in manufacturing. CNT sheets and seamed rolls run successfully on production prepreg machines and are planned for integration into key aerospace systems. Yarns are now produced at the rate of 1km for an 8-hour shift and applications range from mesh antenna structures, wearable electronics, and conductive wiring. R&D will continue on property tailoring but the key need is production scale-up.



Figure 1. Large 8'x4' CNT Sheet



Figure 2. 1km of CNT Yarn

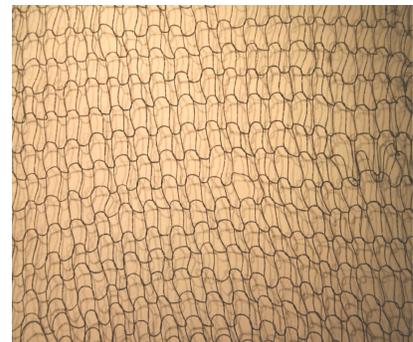


Figure 3. Woven CNT Yarn Antenna

References/Publications

Lashmore, D. and Antoinette, P., High Volume Production of CNT Sheets and Yarns, Burlingame, CA, 9 April 2009.