



Materials and Coatings

Sucrose Treated Carbon Nanotube and Graphene Yarns and Woven Sheets

Cost-effective method to consolidate carbon nanotube and graphene yarns and woven sheets.

NASA Langley Research Center has developed a method to consolidate carbon nanotube yarns and woven sheets and graphene sheets via the dehydration of sucrose. The resulting materials are lightweight and high strength. Sucrose is relatively inexpensive and readily available, therefore the process is cost-effective.

BENEFITS

- ➔ Produces materials with greater than 30% increase in tensile properties compared to starting materials
- ➔ Method uses an inexpensive base material, sucrose, for the manufacturing process
- ➔ Dielectric and electrical properties of the yarns and sheets can be tailored

APPLICATIONS

- ➔ Structural materials for aerospace vehicles
- ➔ Materials for lightweight, mechanically robust consumer devices
- ➔ Materials for space habitats

technology solution



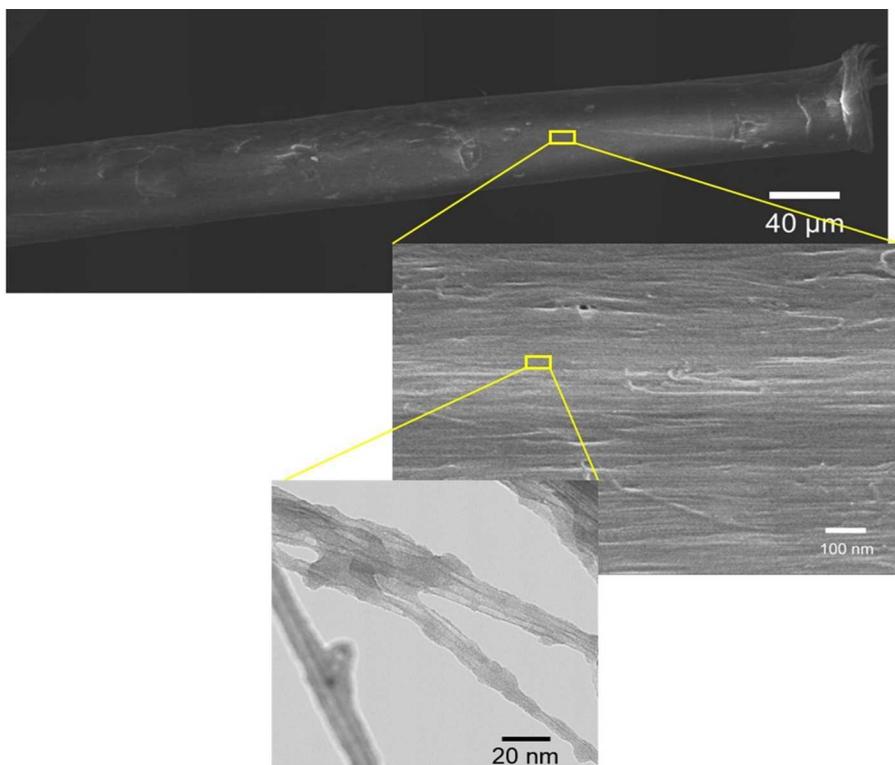
NASA Technology Transfer Program

Bringing NASA Technology Down to Earth

THE TECHNOLOGY

Various aerospace and terrestrial applications require lightweight materials with very high mechanical properties. Carbon nanotubes and graphene sheets have been found to be such materials. In addition, they have been found to have excellent electrical and thermal transport properties. However, retaining the excellent nanoscale properties, particularly mechanical and thermal transport, in bulk materials has proven to be challenging. In order for the nanotubes to be used in applications, they must be spun into yarn(s), sheet(s), and other macroscopic forms introducing relatively weak tube-to-tube and inter-bundle bonds. Also, the nanotubes tend to be entangled, and they therefore do not all contribute in load bearing. Weak coupling at tube and bundle interfaces also leads to mechanical and thermal transport that are much lower than would be expected from the nanoscale carbon nanotube or graphene properties.

This invention is for consolidated carbon nanotube or graphene yarns and woven sheets via the formation of a carbon binder formed from the dehydration of sucrose. The resulting materials are lightweight and possess a high specific modulus and/or strength on the macro-scale. Sucrose is relatively inexpensive and readily available, leading to a cost-effective route for achieving bulk nanotube/graphene based multifunctional material formats.



FE-SEM images of a sucrose treated CNT yarn at various magnifications after dehydration

PUBLICATIONS

Patent Pending



National Aeronautics and Space Administration

The Technology Gateway

Langley Research Center

Mail Stop 151
Hampton, VA 23681
757-864-1178
LARC-DL-technologygateway@mail.nasa.gov

<http://technology.nasa.gov/>

www.nasa.gov

NP-2015-08-2007-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

LAR-18185-1