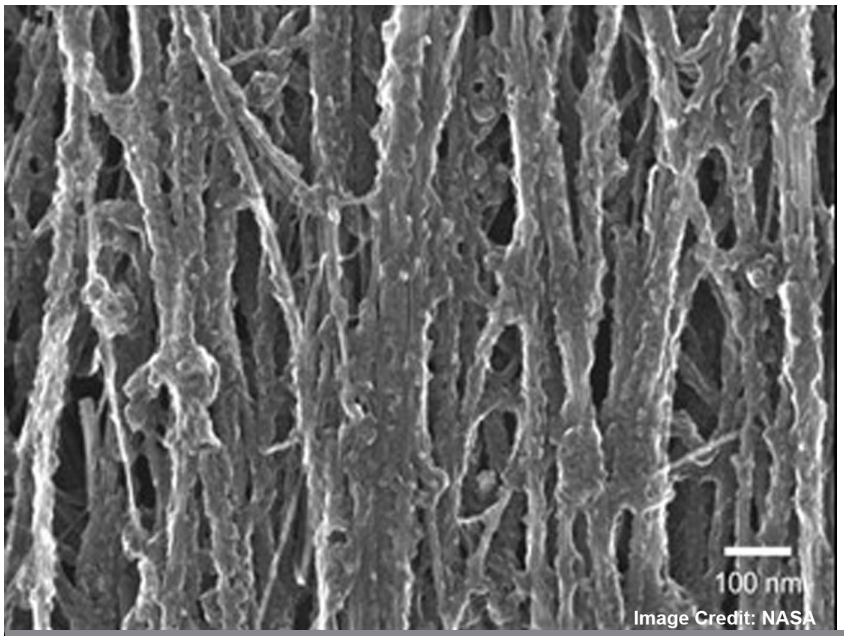


National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Materials and Coatings

Conductive Polymer/Carbon Nanotube Structural Materials and Methods for Making Same

Carbon nanotube structural composites

Scientists at NASA Langley Research Center have developed a composite material that demonstrates improved mechanical properties, approaching those of conventional carbon fiber composites, and possesses relatively high electrical conductivity. Starting with carbon nanotube paper, tape or yarn, the CNT material was impregnated with monomeric aniline with was then polymerized in-situ to create a nanocomposite, followed by stretching, hot pressing and carbonization to densify and improve the interface integrity.

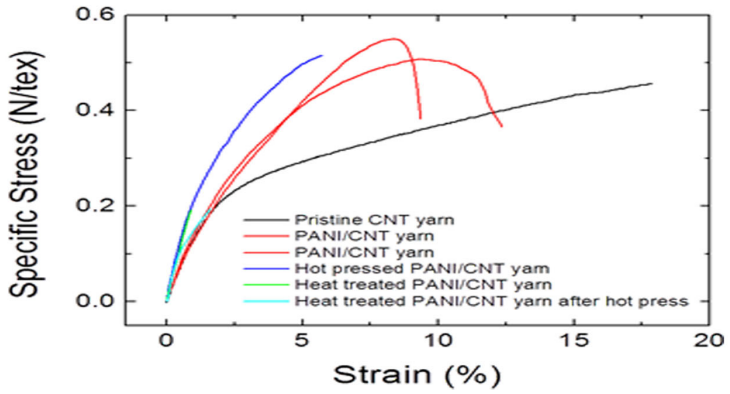
BENEFITS

- Stable binding between CNT tubes and bundles by in-situ polymerization
- Improvement of mechanical properties of CNT sheets or yarns compared to the currently available formats of CNT structural materials
- A wholly new approach for manufacturing CNT-based nanocomposites useful in future structural materials

THE TECHNOLOGY

Carbon nanotubes (CNTs) show promise for multifunctional materials for a range of applications due to their outstanding combination of mechanical, electrical and thermal properties. However, these promising mechanical properties have not translated well to CNT nanocomposites fabricated by conventional methods due to the weak load transfer between tubes or tube bundles.

In this invention, the carbon nanotube forms such as sheets and yarns were modified by in-situ polymerization with polyaniline, a -conjugated conductive polymer. The resulting CNT nanocomposites were subsequently post-processed to improve mechanical properties by hot pressing and carbonization. A significant improvement of mechanical properties of the polyaniline/carbon nanotube nanocomposites was achieved through a combination of stretching, polymerization, hot pressing, and carbonization.



The representative stress-strain curves of the processed polyaniline/CNT yarn nanocomposites under a tensile load. Image Credit: NASA

APPLICATIONS

The technology has several potential applications:

- Light weight structural material for aerospace vehicles including high altitude aerospace flights and space exploration
- Electromagnetic Interference shielding materials including automobile, solar energy housing and buildings, cosmetics, clothing, blankets, helmets, etc.
- Lightning protection for aerospace vehicles
- Flexible structural materials
- Highly conductive flexible materials for electrodes and supercapacitors
- Catalysts embedded in flexible membranes
- Organic thermoelectric materials
- Chemical sensors
- High temperature resistive heating materials

PUBLICATIONS

Patent No: 10,464,271; 11,097,499

technology.nasa.gov

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.

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