TECHNOLOGY

Nondestructive Dispersion of Carbon Nanotubes in Water

OVERVIEW

Background:

Carbon nanotubes (CNTs) are nanosized cylindrical graphene sheets that possess impressive mechanical, thermal, optical and electrical properties which are comparable to some of the strongest well-known materials such as diamond, silicon and steel. As a consequence, they have stirred considerable interest and have been exploited for their use in coatings, microelectronics, batteries, biosensors and medical devices. This particular interest in CNT based products is reflected in global projected revenues of approximately $670 million by 2019 at a growth rate of 33.4%. Typical CNT manufacturing processes, such as the ultrasonication-ultracentrifugation approach, shred the CNT into pieces of various size, significantly reducing the quality and utility of each batch. Furthermore, these formulations have a high tendency to aggregate due to their strong intermolecular attractions, making the process difficult to scale. Other efforts to disperse CNTs require solvents that are toxic or corrosive rendering them incompatible in many industries.

Innovation:

Researchers from the University of Maryland have developed a novel nondestructive method to disperse individual carbon nanotubes. Dubbed Superacid-Surfactant Exchange, this technique produces pure CNTs that are of a single chirality and free of defects in a safe media that is compatible in most applications. This simple solution to a problem that has vexed researchers for decades allows aqueous solutions of individual nanotubes to be prepared within minutes while preserving the full length of the nanotubes. With this method, the length of the processed nanotubes is more than 350% longer than with traditional methods, with a significant fraction approaching 9 m, a length that is limited by only the raw material. The electronic properties are also highly preserved with electrical conductivity in transparent thin films measuring in at 130 /sq (83% transmittance), which well exceeds that of indium tin oxide.

Advantages

· Pure and low defect free CNT populations
· CNTs with enhanced electrical and optical properties
· Solvent compatible with most downstream processes
· Low energy consumption

Applications

· Nanotechnology
· Electronics
· Basic Research

Published article related to this work can be found here:

https://pubs.acs.org/doi/abs/10.1021/acsnano.7b04429

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Additional Information

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PATENT STATUS

Pending

EXTERNAL RESOURCES

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