

Scalable Descaling, Debulking, Debundling, Catalyst Removal and Shortening of Carbon Nanotubes Using Grit Shear Methods

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Researchers at NIST have developed a scalable method to process raw carbon nanotubes (CNT). Currently, the removal of the metallic catalysts and amorphous carbon is a significant barrier to isolating a relatively pure population of carbon nanotubes. High grades (>95% pure) of commercial carbon nanotube cost by weight between \$500-1000/gm. By comparison, at \$700 per ounce, pure carbon nanotubes cost approximately 20-40 times the price of Gold. Current CNT processing methods are not easily scalable, produce significant toxic waste by-products and destroy up to 90% of the starting material.

NIST scientists have invented a low cost, non-toxic, scalable process to generate debundled, debulked, size fractionated carbon nanotubes that could accelerate the development of nanotubes for use in an array of applications ranging from electronics to biotechnology.

The process involves grit shearing using a sharp, light-weight particle that collides with the surface of the CNT material. This is a physical process that removes the brittle, less stable carbon shell "slag" and separates bundles of CNTs to individual or smaller bundles.

Advantages include lower cost, "green process", recyclable, water-based, low energy, scalable (kilogram plus quantities), closed system, no aerosol formation, no organic solvents

Applications include:

- Metrology of sized CNTs, 'nano' standards
- Magnetic alignment
- Drug delivery—crystal growth seeding
- Toxicology & safety studies
- Composites—nano-particle recover from waste oil
- Lithium storage (nano-battery)

A clever, highly innovative, environmentally friendly and extremely low-cost approach to sorting a heterogeneous yield of carbon nanotubes; extremely useful in producing homogeneous batches of nanotubes for industrial use; may be scaled-up to accommodate industrial production. Revenue streams and size are indeterminate at present.

The technology is ready for immediate licensing and commercialization.