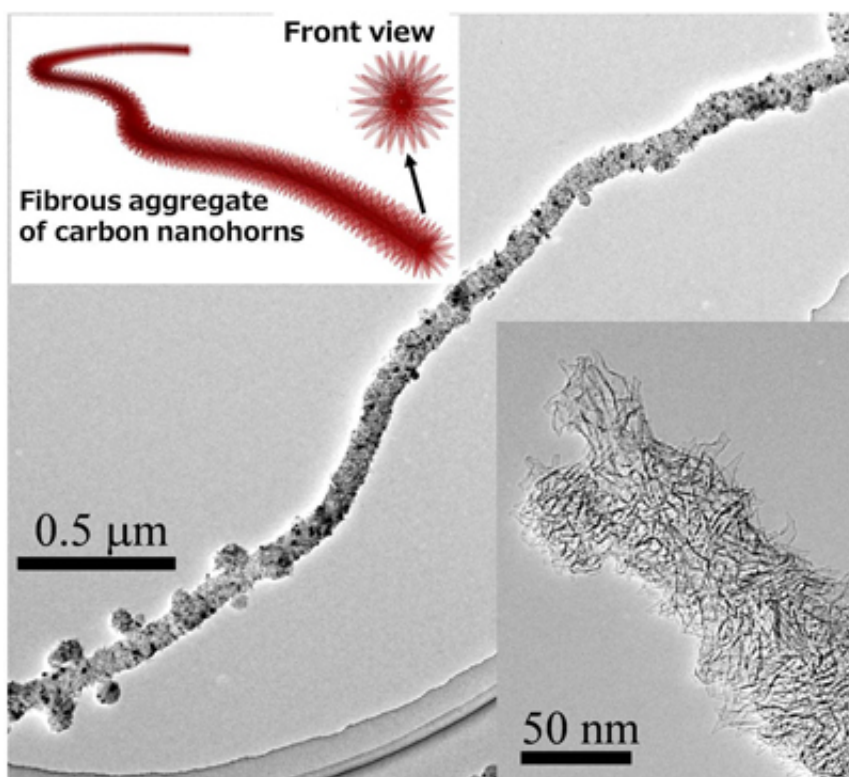


Researchers report the world's first fibrous aggregate of carbon nanohorns

July 7 2016



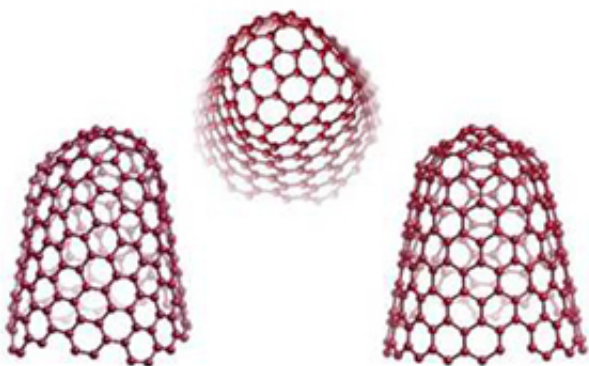
1. TEM images of the obtained samples

NEC Corporation today announced the discovery of a new nano carbon material, the "carbon nanobrush," a fibrous aggregate of single-walled carbon nanohorns. Moreover, NEC has become the first company in the world to manufacture the carbon nanobrush.

Carbon nanohorns are horn-shaped (figure 2) nano carbon structures 2-5 nanometers (nm) in diameter and 40-50nm in length, which until now have been produced as radial spherical aggregates (figure 3). The newly discovered carbon nanobrush is a uniquely shaped material. It is fibrous aggregates composed of radially-assembled graphene-based single-walled nanotubules, named here as fibrous aggregates of single-walled carbon nanohorns, whose structure resembles that of a round brush (figure 1).

"The 'carbon nanobrush' is a new nano carbon material that, like existing carbon nanohorns, has high water and solvent dispersity, and high adsorptivity, including substance adsorption, but has more than 10 times the electrical conductivity than existing carbon nanohorns, an important characteristic for industrial applications," said Dr. Sumio Iijima, Senior Research Fellow, NEC Corporation. "With these characteristics, it is anticipated that the carbon nanobrush will help to improve the basic functionality of a range of devices, including increasing the speed of sensor and actuator responses, improving the output properties of batteries and capacitors, while increasing the electrical conductivity of rubber and plastic composite materials, as well as having application in a wide range of industries."

Features of the "carbon nanobrush" include the following:



2. Tips of single-walled carbon nanohorn

Structure

(1) Single-walled carbon nanohorns of 2-5nm in diameter and 40-50nm in length radially gather and are connected fibrously in several micrometers.

(2) The single-walled carbon nanohorn which is a horn-shaped nano carbon structure with a large [surface area](#) radially gather and are connected fibrously in several micrometers. So it has a [large surface area](#) per unit mass (up to 1700²/g).

Characteristics



3. Spherical-carbon nanohorn aggregates

(1) Dispersity

Like carbon nanohorns, the carbon nanobrush has high dispersibility, dispersing in water and organic solvents, for example. This means that it can be easily mixed with a variety of materials, making it easy to improve its characteristics as a base material.

(2) Adsorptivity

Like spherical carbon nanohorns, the carbon nanobrush can contain various substances in the nano-sized spaces inside the tubular structure, so it can be utilized as a high-performance adsorbent. When holes are formed on the surface of the carbon nanohorns by oxidation treatments, the inner space can be used, expanding the surface area by a factor of approximately five and greatly increasing adsorptivity.

(3) Electrical conductivity

As carbon nanobrush is a fibrous aggregate of radially-assembled carbon nanohorns, it has more than 10 times the electrical conductivity compared with existing spherical carbon nanohorn aggregates. As a result, they are highly effective in increasing the speed of sensor and actuator responses, increasing output properties of batteries and capacitors, and increasing the [electrical conductivity](#) of rubber and plastic composite materials.

Production process

Carbon nanobrush can be produced at room temperature and under atmospheric pressure using the laser ablation method where an iron-containing carbon target (mass of carbon) is irradiated by a laser with high power density. The simple production process means that they can be produced efficiently and at a low cost when compared to the cost of other nano [carbon](#) materials.

More information: Ryota Yuge et al. Preparation and Characterization of Newly Discovered Fibrous Aggregates of Single-Walled Carbon Nanohorns, *Advanced Materials* (2016). [DOI: 10.1002/adma.201602022](https://doi.org/10.1002/adma.201602022)

Provided by NEC Corporation

Citation: Researchers report the world's first fibrous aggregate of carbon nanohorns (2016, July 7) retrieved 10 April 2024 from <https://phys.org/news/2016-07-world-fibrous-aggregate-carbon-nanohorns.html>

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