

Nano technology

# Carbon Nanohorns

The carbon nanohorns (carbon nanohorn aggregates)(CNHs) are potential materials for energy devices, composite materials, and drug applications.

## Features

### Uniform aggregate size

Each carbon nanohorn (CNH) is a graphene-based pseudo tubule having diameters of 2-5 nm and lengths of 40-50 nm. About two thousands of CNHs assemble radially to form a spherical aggregate with diameters of about 100 nm.

### High dispersibility

CNHs are easily mono-dispersed in organic solvents. The dispersion sustains more than 2 weeks. CNHs after oxidation treatments (hole-opening CNHs, CNHox) are mono-dispersed in aqueous solutions.

### High purity, no metallic compound

The purity of CNHs become above 90%. The metallic impurities are not included since metal catalysts are not used in their creation process.

High safety is expected since CNHs are the spherical structure and no metallic impurities.

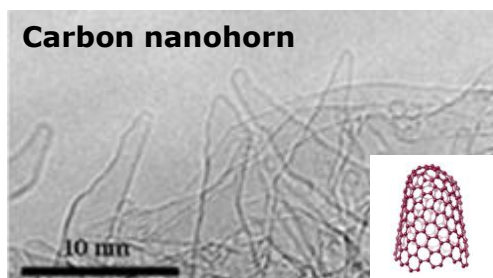
### Large specific surface area

Large specific surface area (above 400m<sup>2</sup>/g). The specific surface area becomes 1300-1400 m<sup>2</sup>/g when CNHs with holes (CNHox) are formed by oxidation treatments.

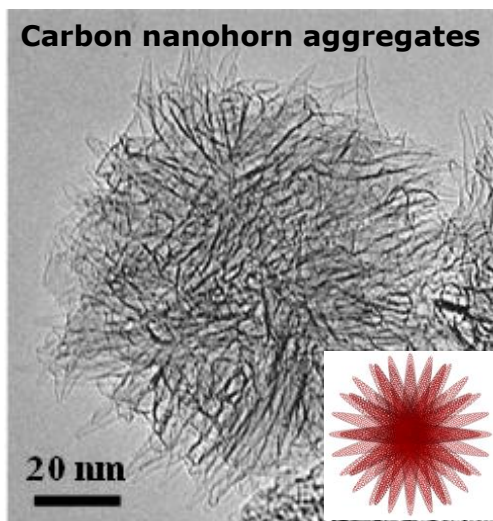
### Utilization of internal space in CNHox

It's easy to incorporate and/or release the various materials.

### Carbon nanohorn



### Carbon nanohorn aggregates



## Applications

### ■ Environment and energy

- Capacitor (Large specific capacity, good durability)
- Fuel cell (Good support materials for catalyst, improvement of utilization efficiency of catalyst)
- Actuator (High-speed response, large displacement)

### ■ Medical

- Drug delivery system (Good carrier to transport the anticancer drug and so on)
- Hyperthermia (CNHs easily generate heats by absorption of light)

### ■ Gas adsorption

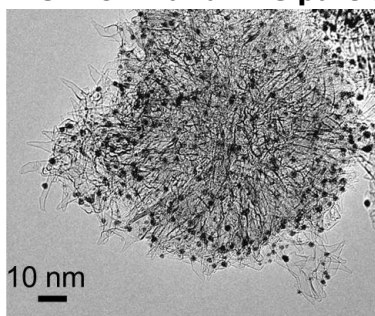
- Adsorbent of highly reactive gases such as fluorine and so on

### ■ Compound material

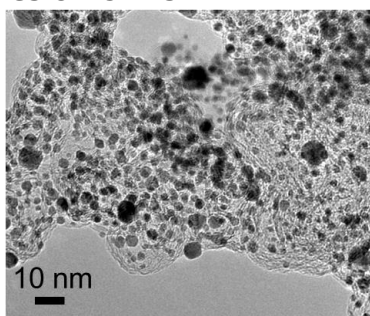
- Excellent additive for characteristic improvement

## Application example (Fuel cell)

### ■ Uniform and fine particles on CNHs



Pt-supported CNHs

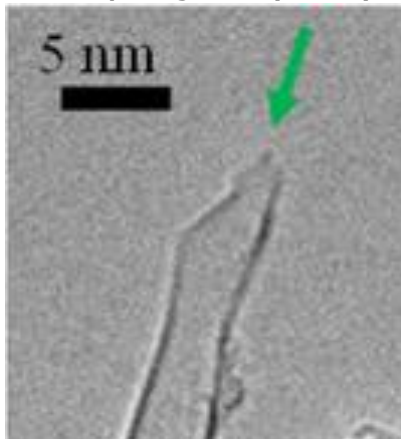


Pt-supported carbon black

## Specification

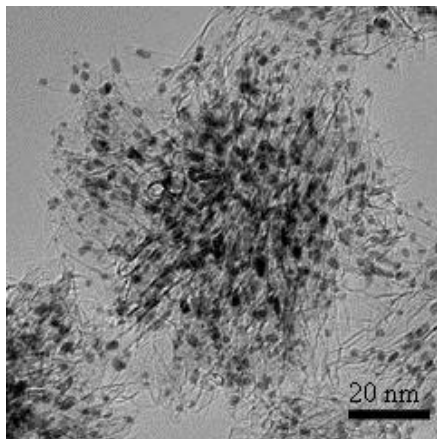
	CNHs (as-grown)	CNHox
Purity	Carbon nanohorns 90% Impurities (graphite, amorphous 10%, metallic compound 0%)	
Diameter	2-5 nm	
Diameter of aggregate	approximately 100 nm	
Specific surface area	400 m <sup>2</sup> /g	1300-1400 m <sup>2</sup> /g
Dispersibility in water	Hydrophobic	Hydrophilic
Electric conductivity of powder (compressed density 0.36g/cm <sup>3</sup> )	1.3 x 10 <sup>0</sup> S/cm	1.2 x 10 <sup>0</sup> S/cm

### ■ Hole-opening CNHs (CNHox)



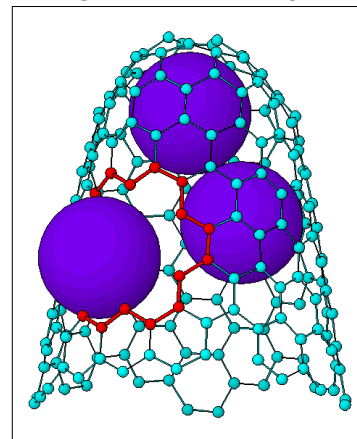
Provided by  
Advanced Industrial Science and Technology (AIST)

### ■ CNHox incorporating Pt-particles



Provided by  
Japan Science and Technology Agency (JST)

### ■ enlarged view at the tip of CNH



## CNH manufacturing equipment

- Continuous laser ablation method
- Production of 1kg/day

## Order unit

- As-grown CNHs (1g-)
- CNHox (1g-)

Please contact us at the following address

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