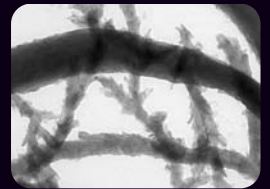
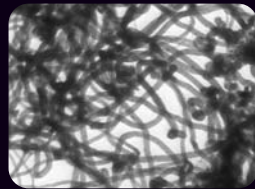
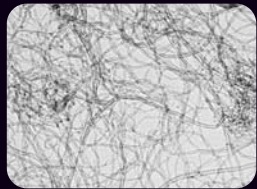


Nano Frontier



**CARBON NANO-MATERIAL TECHNOLOGY**

[www.carbonnano.co.kr](http://www.carbonnano.co.kr)



# Nano Frontier

We Are Pursuing New Order And Change With The Challenging, Creative Spirit

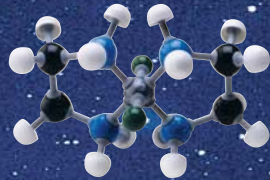
## CARBON NANO-MATERIAL TECHNOLOGY

We, Carbon Nano-material Technology Co., Ltd., succeeded in developing a technology for mass-production of carbon nano-materials at the lowest price levels for the first time in the world by remarkably improving catalyst-producing and synthesizing processes for carbon nano-materials.

### CNT TECHNOLOGY

- CNT/GNF Catalyst Technology
- CNT/GNF Synthesis Technology
- CNT/GNF Shape Control Technology
- CNT/GNF Mass-Production Technology
- CNT/GNF Equipment Manufacturing & Engineering Technology



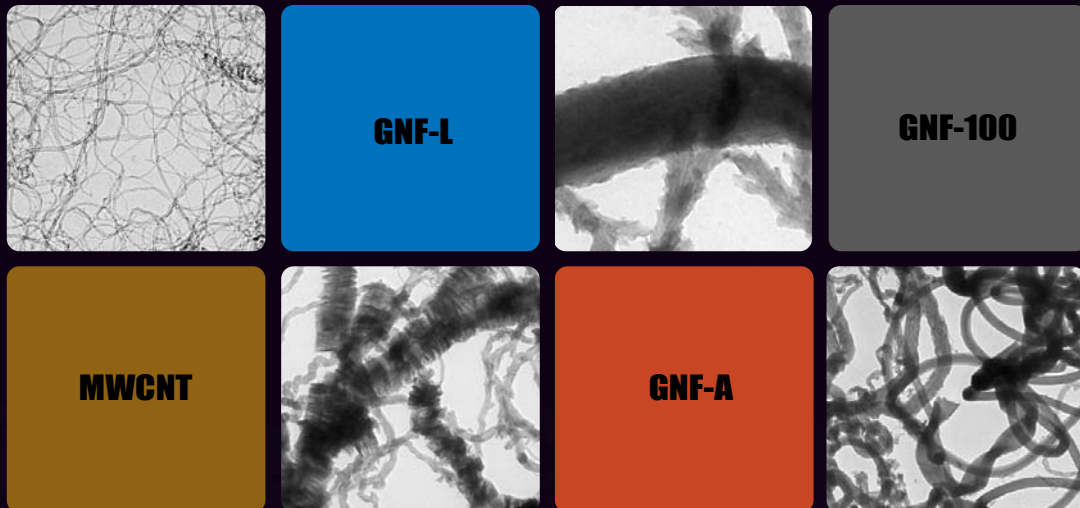


## COMPANY HISTORY

- ~ Sep. 2002 Developed a technology for mass-production of carbon nano-materials at the lowest price levels
- Oct. 8, 2002 **Applied for a patent** on the method of manufacturing carbon nano-materials  
(Application No. 2002-0061310)
- Nov. 6, 2002 **Applied for a patent** on the method of manufacturing cathode materials by using carbon nanofiber  
(Application No. 2002-0068566)
- Dec. 5, 2002 Established Carbon Nano-material Technology Co., Ltd.
- May 2003 Participated in the Industry-University-Lab Consortium Project promoted by the Small & Medium Business Administration
- July 2003 Selected as a major research organization for the Small & Medium Business Innovation & Development Project promoted by the Small & Medium Business Administration
- Aug. 2003 Selected as a major organization for the TBI Project promoted by the Ministry of Commerce, Industry and Energy
- Oct. 6, 2003 **Applied for two patents**  
Application No. 2003-0069331 method of manufacturing a catalyst for manufacture of carbon nano-materials and the catalyst for manufacture of carbon nano-materials  
Application No. 2003-69332 method of manufacturing carbon nano-materials
- Dec. 10, 2003 **Designated as a venture business** (a new technology company) (No. 031323035-05286)
- Feb. 23, 2004 Developed a carbon nanofiber "CNF-LSA" with improved specific surface area
- Mar. 4, 2004 **Designated as a company specializing the manufacture of components and materials** by the Ministry of Commerce, Industry and Energy (No. 1121)
- July 30, 2004 **Designated as a "Superior Exporting Firm"**  
Daegu - Gyeongbuk Export Assistance Center
- Oct. 5, 2004 **Applied for a Patent** on the method of Making Catalyst for Carbon Nanotubes, Carbon Nanofibers and Catalyst for Carbon Nanotubes, Carbon Nanofibers.  
(Application No. PCT/KR2004/002546)
- April 11, 2005 Participated in "NANO FAIR 2005" (Hanover, Germany)
- June 22, 2005 **Applied for a Patent** on the method of Making Catalyst for Fuel Cell (Application No. 2005-0054074)

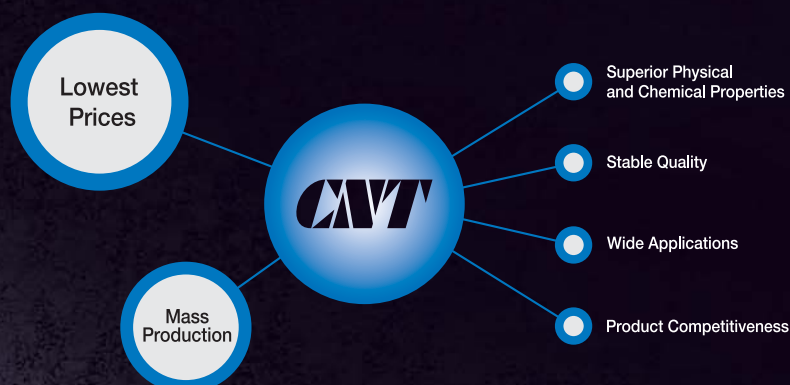
# Nano carbon is our Future

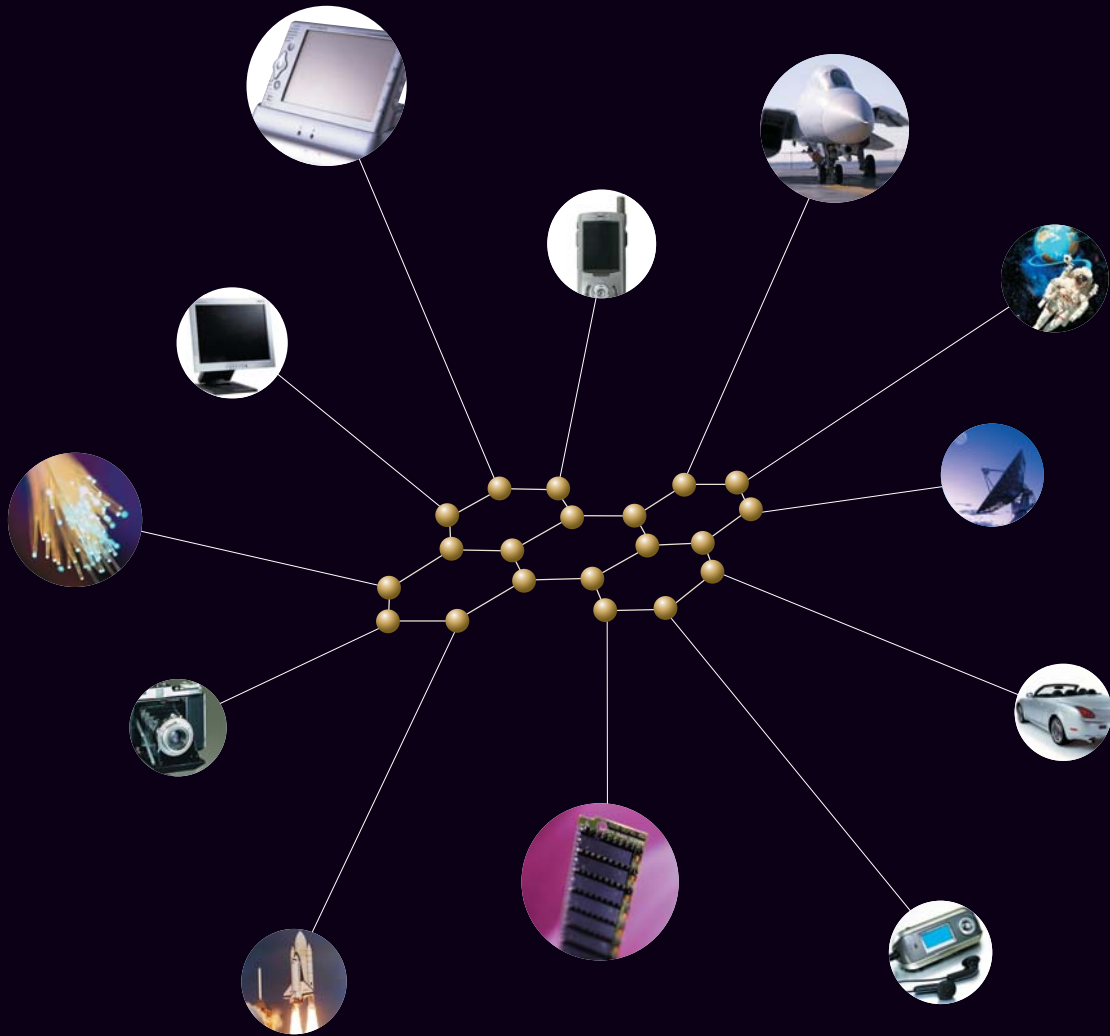
## CARBON NANO-MATERIAL TECHNOLOGY



Carbon nano-materials(carbon nanotube and graphite nanofiber) are innovative materials in the 21st century. These materials that are very small in size and has superior mechanical, chemical, physical and magnetic properties have been being spotlighted as next-generation materials for such fields as electron emitter, composites, EMI & ESD shielding materials, rechargeable battery, fuel cell and nano mechatronics. Up to date there have been no technologies that make it possible to mass-produce carbon nano-materials at a low price. So the development of technologies for application of carbon nano-materials has also been being delayed. Although these materials are very excellent advanced materials, they are not able to bring about such useful effects as substitution for existing materials and creation of new applications unless they are not mass-produced at low prices like iron.

We, Carbon Nano-material Technology Co., Ltd., succeeded in developing a technology for mass-production of carbon nano-materials at the lowest price levels for the first time in the world by remarkably improving catalyst-producing and synthesizing processes for carbon nano-materials. The field of future materials will turn from the age of iron into the age of carbon, and carbon nanotube and graphite nanofiber will be the key materials that will represent the coming age of carbon. With the challenging, creative spirit, we will be a world leader of carbon nanotechnology.





## Global Leader

Carbon Nano-material Technology

Carbon nano-materials are the 21st century's innovative materials that have superior mechanical, chemical, physical and electromagnetic properties to existing bulky materials. We, Carbon Nano-material Technology Co., Ltd., developed a technology for mass-production of carbon nano-materials at the lowest price levels by remarkably improving catalyst-producing and synthesizing processes for carbon nano-materials. Therefore, we are the only company that is able to help you enhance your competitiveness and product quality.

# Carbon NanoTube

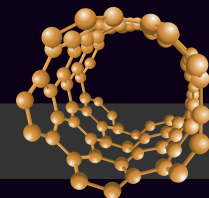
## CNT

### GENERAL

- New Dream Material in the 21st Century (Widely Applications to the Scientific Areas)  
: Aerospace, Bio-engineering, Energy, Medical and Medicine, Electronic, Computer, Security & Safety
- Single & Multi-walled Nanotube : Tubular Material with a Hexagonal Honeycomb Structure
- Good Electric Conductivity & Mechanical Strength, High Efficient Hydrogen Storage, Outstanding in Chemical Stability

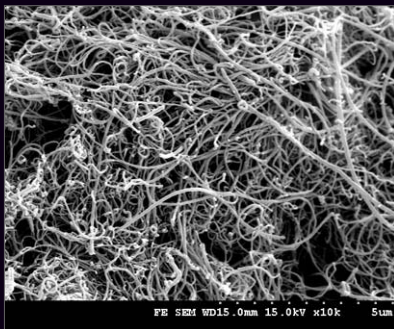
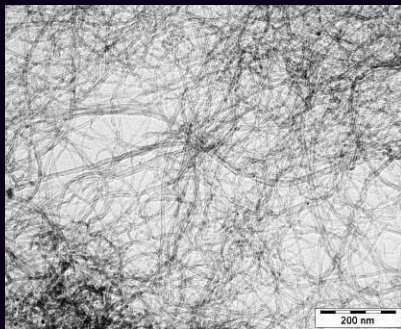
### APPLICATION

- Electron Emitter : FED(Field Emission Display), VFD(Vacuum Fluorescent Display), White Light Source
- Shielding Materials : Electro-magnetic Interference(EMI), Electro-static Discharge(ESD)
- Carbon Semiconductor : Terabit DRAM Device
- Power Source : Rechargeable Battery, Hydrogen Storage, Fuel Cell Catalyst
- Mechatronics(Nanoscale Tools) : Nano Wire, Nano Pipet, Nano Capsule, Nano Tweezer
- Others : Conductive paint/resin and heat-radiating materials



## MWCNT

multi-walled carbon nanotube



Diameter : ~20nm  
 Length : ~10um  
 Aspect Ratio : > 500  
 Purity : > 85 wt%  
 Specific Surface Area : 100~700m<sup>2</sup>/g  
 Bulk Density : 0.08 ~ 0.1(g/cm<sup>3</sup>)

## Comparison of Properties of Carbon Nano-materials

PROPERTIES		Graphite Nanofiber (GNF)	Carbon Nanotube (CNT)
Density		1.8~2.2 g/m <sup>3</sup>	> 1.0 g/m <sup>3</sup>
Electronic Property		Semimetal	Metal/Semiconductor
Interlayer Spacing		3.40 Å	3.38~3.41 Å
Thermal Conductivity		1,000~2,000 W/m·K	1,800~6,000 W/m·K
Electrical Properties	Resistivity	10 <sup>-3</sup> ~0.23 Ω/cm	10 <sup>-4</sup> ~10 <sup>-5</sup> Ω/cm
	Current Density	1~10 <sup>2</sup> A/m <sup>2</sup>	10 <sup>13</sup> A/m <sup>2</sup>
Structural Properties	Aspect Ratio	> 3,000~4,000	> 10,000
	Surface Area(BET)	300~700 m <sup>2</sup> /g	100~700 m <sup>2</sup> /g
Elastic Properties	Young's Modulus	150~820 Gpa	~1,000 Gpa
	Tensile Strength	1~3 Gpa	~30 Gpa

# Graphite Nanofiber

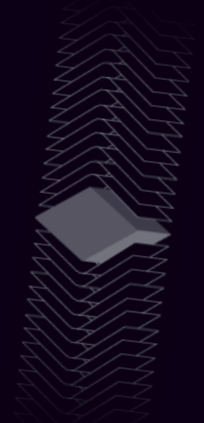
GNF

## GENERAL

- Excellent Physico-Chemical Characteristics (Widely Applications)
  - : High Specific Surface Area, Good Electric Conductivity & Mechanical Strength, etc.
- Well Ordered Graphite Structure
- Outstanding in Chemical Stability, High Energy Density & Efficiency, Excellent Storage & Durability,

## APPLICATION

- Shielding Materials : Electro-magnetic Interference(EMI), Electro-static Discharge(ESD)
- Filler of Composites : Aircraft Heat Sinks, Electrical Polymer Composites, Body Materials
- Battery Materials : Fuel Cell Catalyst, Solar Cell, Rechargeable cathode
- Hydrogen Storage : Power Source
- Electric Double Layer Capacitor : Memory Back-up(Computers, Camcoders, Cellular Phones etc.)



## GNF-100



Structure : Stacking Arrangement  
(Herringbone type)

Diameter : ~200nm

Length : ~30um

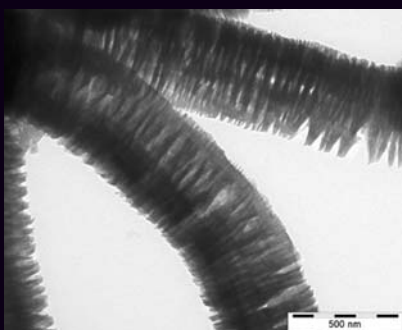
Aspect Ratio : >100

Purity : >90 wt%

Specific Surface Area : 100 ~ 300m<sup>2</sup>/g

Bulk Density : 0.15 ~ 0.18(g/cm<sup>3</sup>)

## GNF-L



Structure : GNF-L (Segment)  
GNF-A (Antler)

Diameter : ~300nm

Length : ~30um

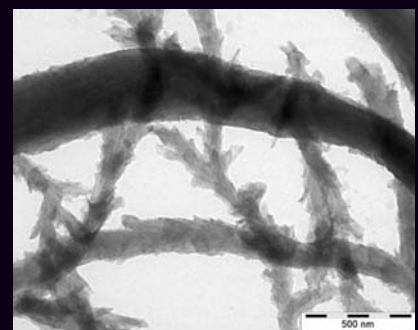
Aspect Ratio : >100

Purity : >90 wt%

Specific Surface Area : >100m<sup>2</sup>/g

Bulk Density : 0.12 ~ 0.15(g/cm<sup>3</sup>)

## GNF-A





**Carbon Nano-material Technology**

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