

## Technical Data Sheet

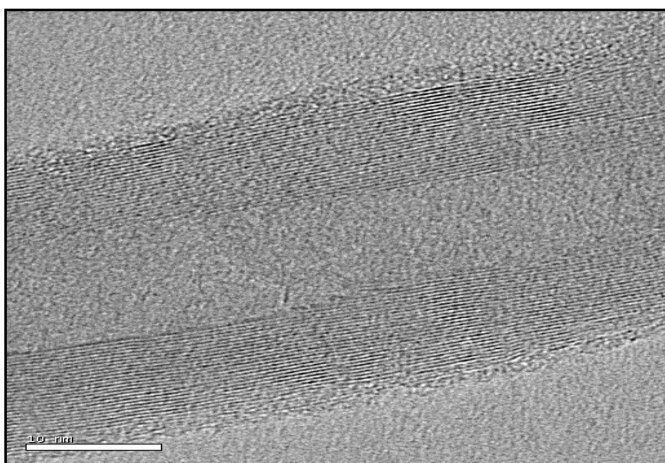
### IENT Multi-walled Carbon Nanotubes (MWNTs)

Carbon Nanotubes are produced by the closed controlled CVD method. This product is suitable as reinforcement filler in base polymers for the fabrication Nano-composites/bio-Nano-composite.

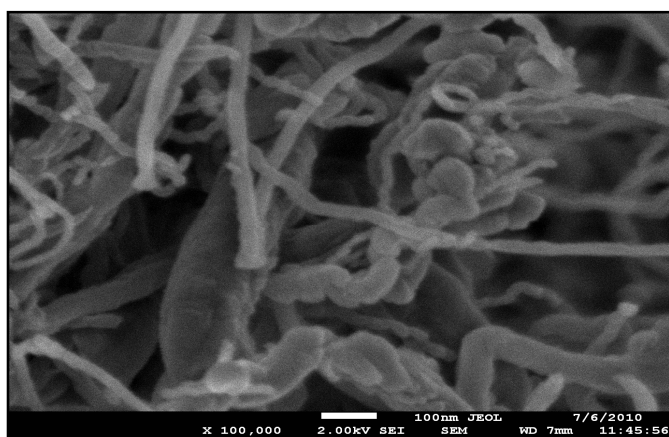
MWNT	Description	Characterization method
Production method	Chemical Vapor Deposition [CVD]	Closed controlled Method
Available form	Black powder	Visual
Diameter	~ 10nm	SEM,TEM
Length	6-9 micron	SEM, TEM
Nanotubes purity	>98%	TGA,RAMAN
Metal particles	<1%	ICP-MS
Amorphous carbon	<1%	HRTEM
Specific Surface area	250-300 m <sup>2</sup> /g	BET
Bulk density	0.10-0.06 g/cm <sup>3</sup>	Pycnometer

#### Notes:

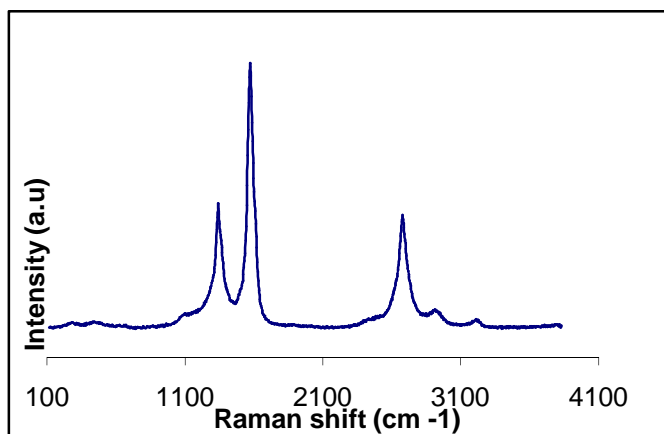
- It should be stored in a cool, dry, well-ventilated place.
- It should be used gently and operated in enclosed place with exhaust fan.
- Wearing suitable respiratory protective mask, chemical safety protective glasses and gloves is required.
- While using water fog, foam, dry chemicals or carbon dioxide to put out fire, wearing suitable respiratory protection equipment is necessary.
- Generally, its chemical properties are stable; Avoiding heat, fire and strong Oxidants are recommended.



TEM image showing MWNTs product with typical one dimensional Structure of 10 to 15 nm dia.



SEM image showing MWNTs product with typical one dimensional entangled structure 6-9 micron.



Raman spectrum of MWNTs Powder showing a strong G band and a low D/G ratio confirming the pristine nature of these products. The 2D band shape at ca. 2700cm<sup>-1</sup> also confirms the absence of graphite.

## Applications of Carbon Nanotubes

**CNT's Field Emission Applications:** CNTs Conductive Plastics EMI/RFI shielding composites; coatings for enclosures, gaskets, and other uses; electrostatic dissipation (ESD); conductive coatings; and radar-absorbing materials for low-observable ("stealth") applications.

**CNT's Energy Storage:** electrodes in batteries and capacitors, CNTs are outstanding materials for supercapacitor electrodes and fuel cell components.

**CNT's Conductive Adhesives and Connectors:** Conductive fillers for use in electromagnetic shielding, ESD materials, etc. interconnection applications, such as adhesives, potting compounds, and coaxial cables.

**CNT's Thermal Materials:** Application in advanced computing, where uncooled chips now routinely reach over 100 °C. Composites with CNTs have been shown to dramatically increase their bulk thermal conductivity, even at very small loadings.

**CNT's Structural Composites:** Mechanical properties such as stiffness, toughness and strength.

**CNT's Fibers and Fabrics :** Body and vehicle armor, transmission line cables, woven fabrics and textiles. CNTs are also being used to make textiles stain resistant.

**CNTs Biomedical Applications :** Vascular stents, and neuron growth and regeneration. A single strand of DNA can be bonded to a nanotube, which can then be successfully inserted into a cell.

**CNTs Air and Water Filtration :** CNT based air and water filtration devices can not only block the smallest particles but also kill most bacteria.

**CNTs Ceramic Applications :** A ceramic material reinforced with carbon nanotubes is far tougher than conventional ceramics, conducts electricity and can both conduct heat and act as a thermal barrier.

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**IEN Inc.** | 26/57-B, Agilmedu, 5th Street,  
Sait Colony, Erode-638001, TamilNadu, India.  
0424-4542501; +91 9442264501

[www.nanoient.org](http://www.nanoient.org); Email: [ient.conseltant@gmail.com](mailto:ient.conseltant@gmail.com)