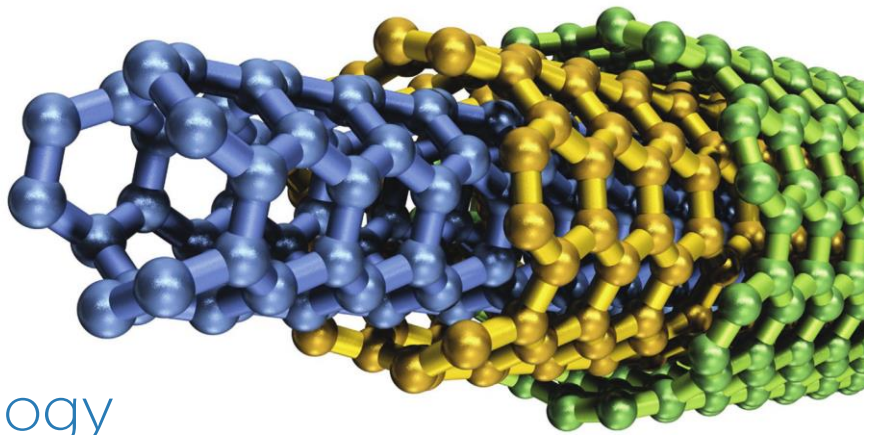


PRODUCT CATALOG

2020

Enabling
the Future
through
Nanotechnology



www.nanointegris.com
sales@nanointegris.com
T: 1.866.650.0482



2020 Product Catalog

Brief History

In October 2006, Professor Mark Hersam’s research group at Northwestern University published a ground-breaking paper in Nature Nanotechnology describing a process to sort CNTs by electronic structure. Flooded with sample requests from around the world, NanoIntegris was founded in January 2007 and established in Skokie, Illinois. Raymor, a high-value added materials supplier, acquired NanoIntegris in 2012 to expand its client base and its expertise in nanotube processing.

Over the past 11 years, NanoIntegris’ materials have been featured in over 1,300 publications worldwide and has enabled various technologies such as Gas Detectors, OLEDs, Drug Delivery, and Computer Logic. Raymor Industries has developed its plasma processing capability which led to two outstanding products: plasma-grown single-wall carbon nanotubes (SWCNT) and plasma-grown crumpled graphene nanoplatelets.

Raymor and NanoIntegris offer a wide variety of premium nanomaterials to companies and academic institutions developing next-generation electronics, energy, and biomedical technologies. We pride ourselves on our thorough, accurate, and honest material characterization.

Our nanotube powders, inks for printed electronics, and dispersions are among the purest in the industry. What is more, our strict ISO 9001 quality control standards and procedures enable us to guarantee the reliability and consistency of our products. If you have further questions, please don’t hesitate to contact us.

MISSION



To develop and commercialize new advanced nanomaterials that deliver breakthrough performance results for various industrial products and reduce the global environmental footprint.

VISION



Become the world leader in the supply of high purity semi-conducting and metallic single wall carbon nanotube solutions for the electronics industry and of high purity few layers graphene for the battery industry.

VALUES



RESPECT – TEAMWORK –
INNOVATION – INTEGRITY –
ENVIRONMENT



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- Tel: 416-509-4462
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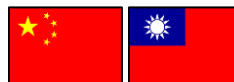
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Prime Machine Tools

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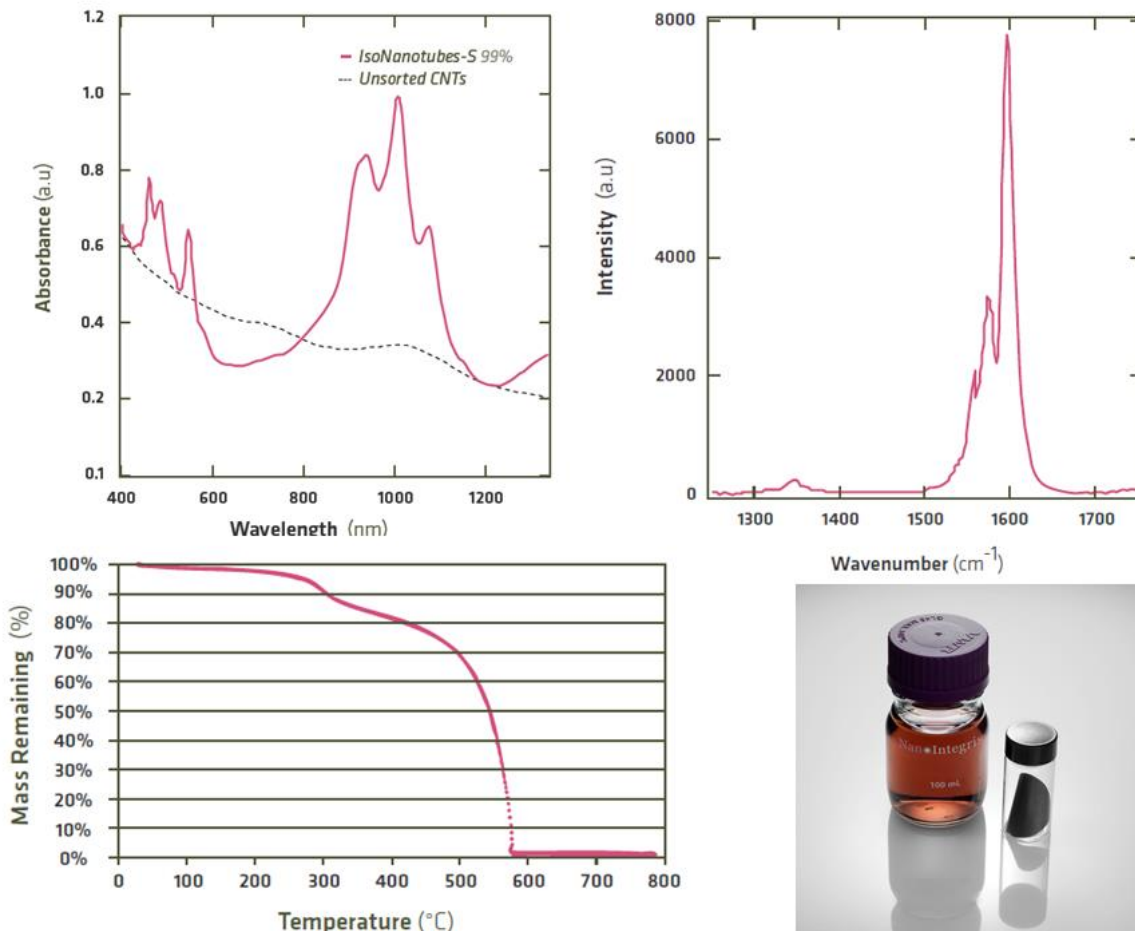
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IsoNanotubes-S: Semiconducting SWCNT

Description: The IsoNanotubes-Semiconducting product has been successfully utilized in numerous scientific works over the years. The primary usage for the IsoNanotubes-S material is for the creation of thin film transistors. Because of the high single-walled nanotube purity, length, pristine surface, and semiconducting properties, the IsoNanotubes-S material has proven beneficial in applications such as Gas Detection, Temperature Sensing, CMOS circuit creation, and has laid the ground work for the development of novel and exciting technological advancements, and within the backplanes of LCD and OLED displays. As the flexible electronics industry matures, TFTs will likely be incorporated into an even wider range of commercial electronics.

Please note that SKU# 1117 and 1118 use SWCNT from the CoMoCAT process.

Specifications:



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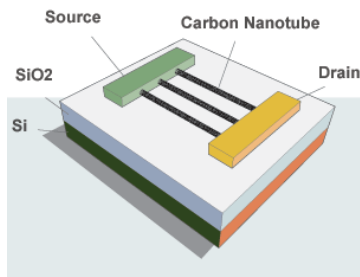
Parameter	IsoNanotubes-S
Available Purities	90%, 95%, 98%, 99% and 99.9%
Metal content from TGA	< 1%
Length from AFM	0.3-4 μ m
Solvent	Water or Toluene
Diameter range	1-1.7 nm

Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1101	IsoNanotubes-S 99% Solution	\$799	1.0
1102	IsoNanotubes-S 99% Thick Film	\$849	1.0
1103	IsoNanotubes-S 98% Solution	\$449	1.0
1104	IsoNanotubes-S 98% Thick Film	\$499	1.0
1105	IsoNanotubes-S 95% Solution	\$299	1.0
1106	IsoNanotubes-S 95% Thick Film	\$349	1.0
1107	IsoNanotubes-S 90% Solution	\$199	1.0
1108	IsoNanotubes-S 90% Thick Film	\$249	1.0
1115	IsoNanotubes-S 99.9% Solution	\$899	1.0
1116	IsoNanotubes-S 99.9% Thick Film	\$949	1.0
1117	(6,5) Chirally Enriched 95% Solution	\$1,149	200.0
1118	(6,5) Chirally Enriched 95% Thick Film	\$1,149	1.0g

Significant discounts are available for large size orders. Please contact our sales team for a special quote.

Did you know?

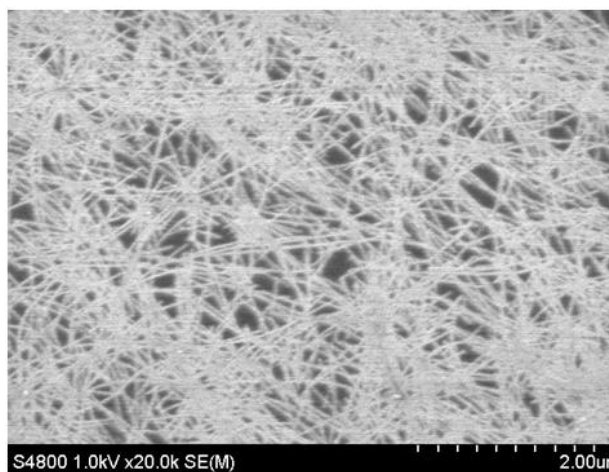
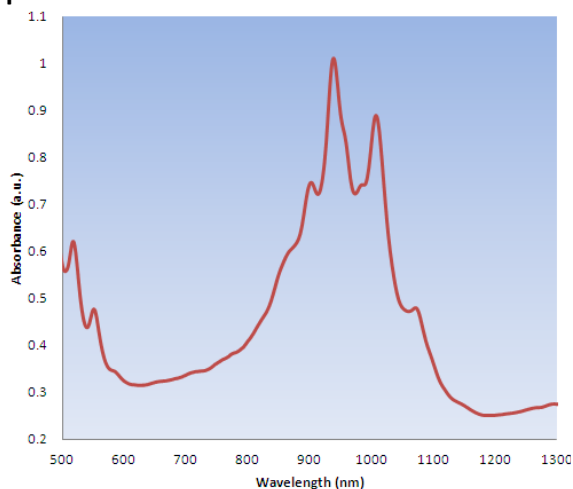


Semiconducting carbon nanotubes may replace or complement traditional semiconductors in both high-performance and low-cost thin film transistor (TFT) devices. Today, TFTs are most commonly used in the backplanes of LCD and OLED displays. As the flexible electronics industry matures, TFTs will likely be incorporated into a much wider range of commercial electronics.

IsoSol-S: Semiconducting SWCNT

Description: IsoSol-S100 is the award-winning semiconducting carbon nanotube ink with the highest purity ever measured coupled to a fully scalable manufacturing route that does not rely on ultracentrifugation. When processed optimally, our solution leads to carbon nanotube thin-film transistors (SWCNT-TFT) that delivers average mobilities of 10-20 cm²/V/s and current ON/OFF ratios of 10³-10⁶ (on Si/SiO₂) as well as average current densities of 1-10 μA/μm, sufficient in principle to drive organic light-emitting diodes (OLEDs) and is an outstanding material for the development of CNT-based macroelectronics and flexible electronics. The semiconducting single-wall carbon nanotubes are sourced from the highly-scalable RF-plasma process, and separated using conjugated polymer extraction.

Specifications:



Property	Value
Optical Purity	>99.9%
I _t k _i s Ratio (Ī)	>0.50
Phi Value (Φ)	>0.40
Nanotube Concentration	> 0.01mg/mL
Surfactant : Nanotube Concentration	1-10
Standard Solvent Media	Toluene
Shelf Life	3 months

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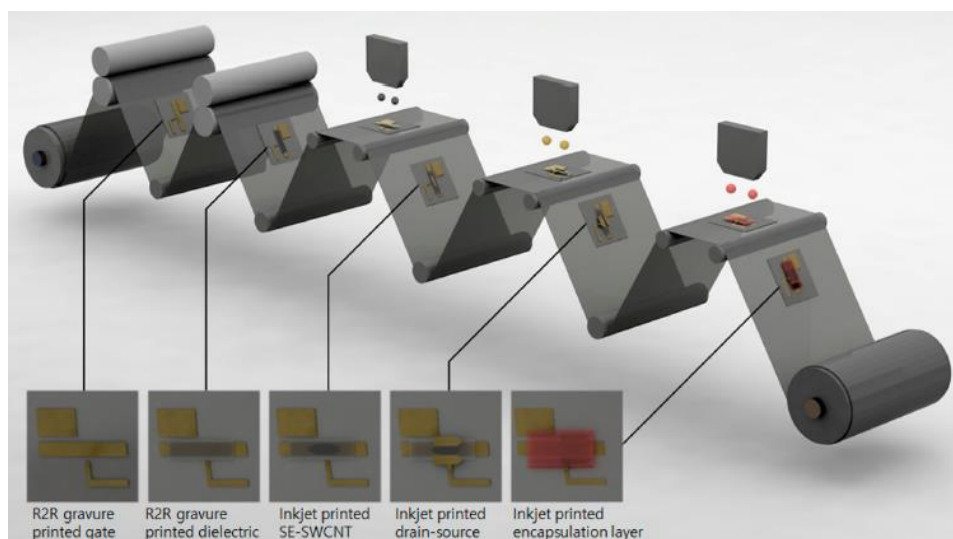
2020 Product Catalog

Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1111	100% IsoSol-S100 Polymer Wrapped Film	\$795	1.0
1112	100% IsoSol-S100 Aromatic Solution	\$695	1.0

Discounts are available for large size orders. Please contact our sales team for a special quote.

Did you know?



Transistors can be printed using roll-to-roll (R2R) gravure on flexible polyethylene terephthalate (PET) substrate with silver gate electrodes and a high-k BaTiO₃ dielectric layer. The IsoSol-S100 was inkjet-printed at 50 mg/L along with silver source/ drain contacts, defining a channel of 1000 μm x 150 μm. The on/off ratios were determined to be 7×10⁴ with a subthreshold swing of 1.8V/decade, a threshold voltage of -2.5V, and a mobility of 6cm²/Vs.

Reference: *ACS Appl. Mater. Interfaces* 2016, 8, 27900-27910.



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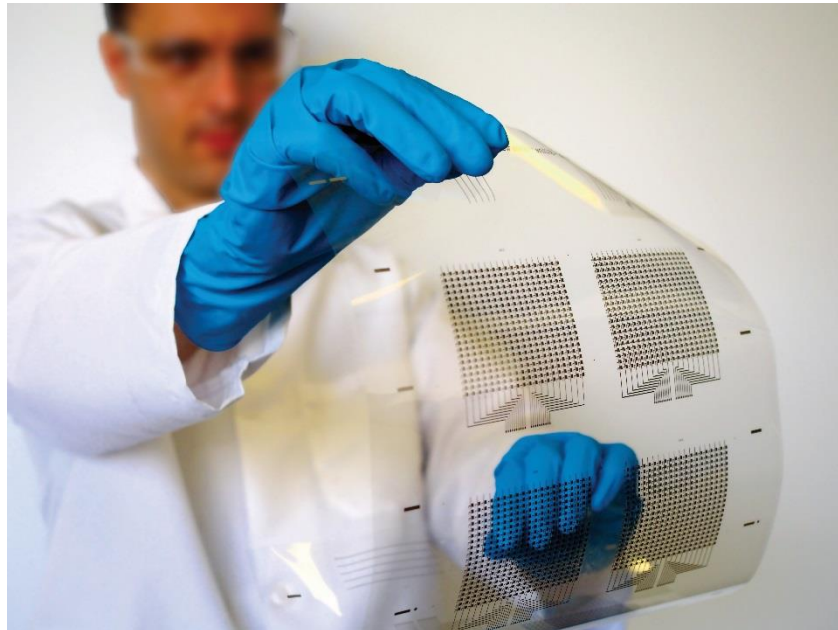
Semiconducting and Dielectric Ink Package

Description: NanoIntegris has begun selling a complementary thin film transistor package. The materials package combines a new **dielectric ink (XDI-DCS)** developed at the XRCC with NanoIntegris' high purity, single-walled carbon nanotube ink (IsoSol-S100), to improve the overall performance of printed high-mobility p-type transistors. Compatibility between semiconducting and dielectric materials is critical for reliable processing and device performance.

One of the challenges that have limited the implementation of single-walled carbon nanotube based thin film transistors is that they exhibit considerable hysteresis with a non-zero threshold voltage when exposed/operated in air ambient. This new materials package addresses performance issues when the **XDI-DCS ink** is used as a **dielectric**, and when further used as an encapsulant. Key to addressing issues such as hysteresis is the hydrophobic surface of the dielectric layer, which can eliminate water and mitigate charge trapping. Both materials have low viscosity, enabling spin coating, inkjet printing or aerosol deposition, and can be cured at or below 150 °C, making them compatible with the most popular low temperature substrate polyethylene terephthalate (PET).

Further details: *J. Lefebvre et al. Hysteresis free carbon nanotube thin film transistors comprising hydrophobic dielectrics. Appl. Phys. Lett. 107, 243301 (2015).*

Specifications:



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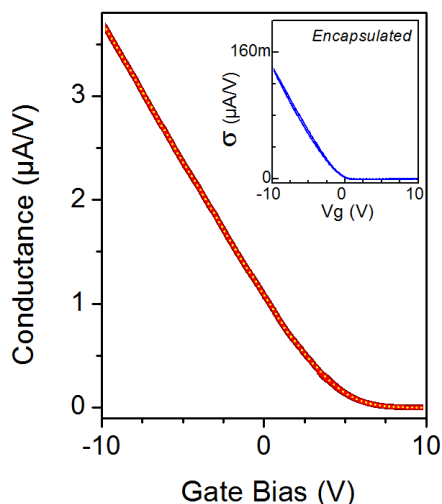
Solution Characteristics		
Metric	IsoSol Semiconductor	Xdi-dcs Dielectric
Viscosity at 25 °C	18-22 cps	8-9 cps
Surface Tension	25-30 mN/m	24-25 mN/m
Solvent System	organic	organic
Cure (thermal, air)	150 °C / 10 min	140 °C / 30 min
Shelf Life	up to 3 months	up to 2 months
Preferred Deposition Method	Aerosol	Spin-coating
Thin Film Transistor Characteristics		
Metric	Value (in air)	Value (encapsulated)
Mobility	40 cm ² /V/s	> 6 cm ² /V/s
On/Off Ratio	1 x 10 ⁴	1 x 10 ²
Threshold Voltage	4 ± 1 V	0 ± 1 V
Hysteresis	0.004 ± 0.03 V	0.004 ± 0.03 V
Dielectric Constant	4	4
Dielectric Layer Thickness	~ 500 nm	530 nm

Prices:

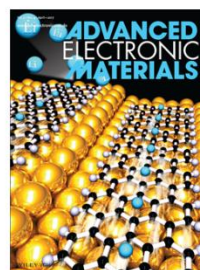
SKU#	Product	Price (USD)	Quantity
1121	XDI-DCS Dielectric Ink	\$160	10 g
1122	10g XDI-DCS Ink + 1mg IsoSol-S100	\$775	1 Package

Please view page 8 for the details of IsoSol-S100 semiconducting ink.

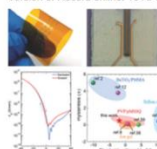
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AS FEATURED IN...



Completely Printed, Flexible, Stable, and Hysteresis-Free Carbon Nanotube Thin-Film Transistors via Aerosol Jet Printing
Changyong Cao, Joseph B. Andrews and Aaron D. Franklin
Version of Record online: 10 APR 2017 | DOI: 10.1002/aelm.201700057



Completely printed, flexible, stable, and hysteresis-free carbon nanotube thin-film transistors (CNT-TFTs) are fabricated by aerosol jet printing. The printed dielectric shows negligible hysteresis with excellent stability of electrical performance even under significant bias stress. The fully printed CNT-TFTs are readily compatible with flexible substrates, exhibiting negligible change in electrical characteristics after thousands of aggressive bending cycles.

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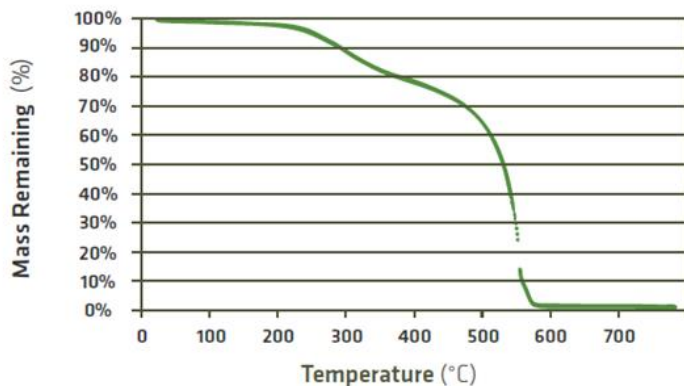
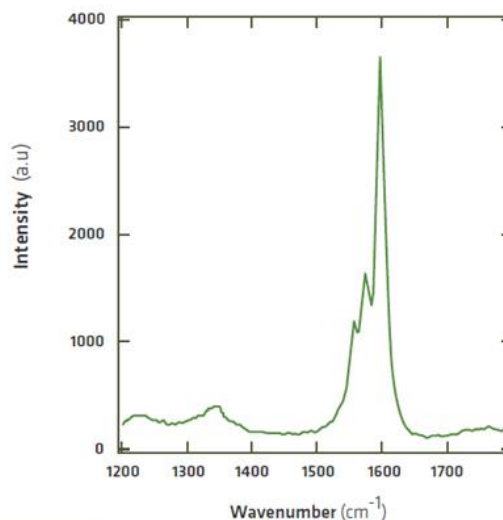
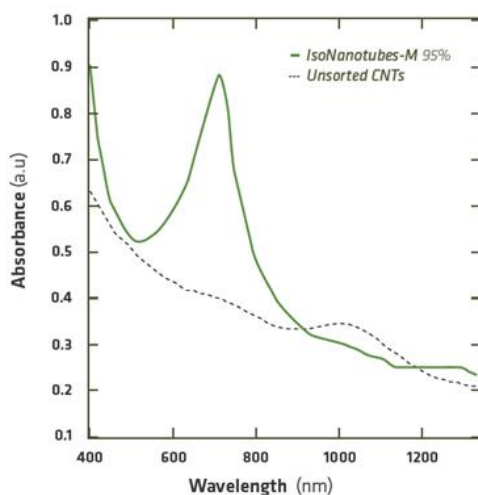
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IsoNanotubes-M: Metallic SWCNT

Description: Metallic single-wall carbon nanotubes are a NanoIntegris exclusive! With the ability to deposit this material onto various substrates at low temperature, the IsoNanotubes-M product can serve as a flexible alternative to ITO, along with numerous other technical applications. They are sorted using our patented density gradient ultracentrifugation (DGU) process and offered in an aqueous solution or a thick film/ buckey paper form.

Specifications:



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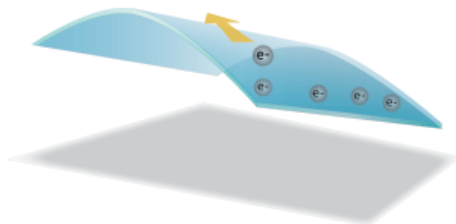
Parameter	IsoNanotubes-M
Available Purities	70%, 90%, 95%, 98% and 99%
Metal content from TGA	< 1%
Length range from AFM	0.3-4 μ m
Solvent	Water
Diameter range	1-1.7 nm

Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1201	IsoNanotubes-M 99% Solution	\$899	1.0
1202	IsoNanotubes-M 99% Thick Film	\$949	1.0
1203	IsoNanotubes-M 98% Solution	\$699	1.0
1204	IsoNanotubes-M 98% Thick Film	\$749	1.0
1205	IsoNanotubes-M 95% Solution	\$399	1.0
1206	IsoNanotubes-M 95% Thick Film	\$449	1.0
1207	IsoNanotubes-M 90% Solution	\$299	1.0
1208	IsoNanotubes-M 90% Thick Film	\$349	1.0
1209	IsoNanotubes-M 70% Solution	\$199	1.0
1210	IsoNanotubes-M 70% Thick Film	\$249	1.0

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Did you know?

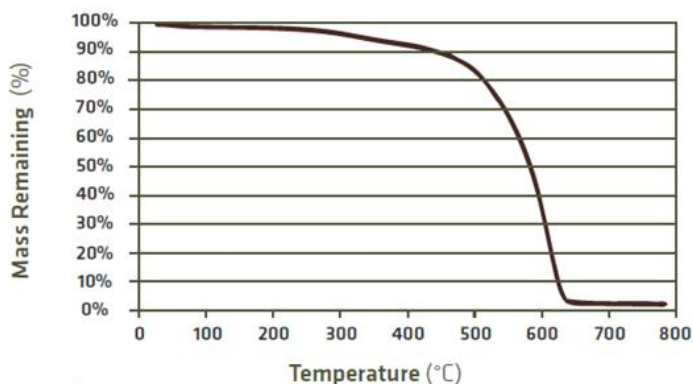
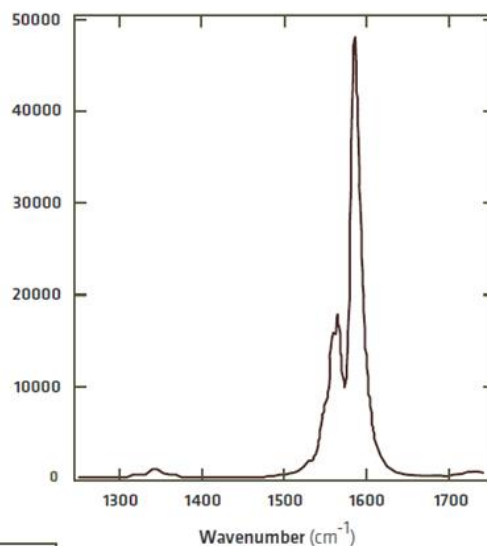
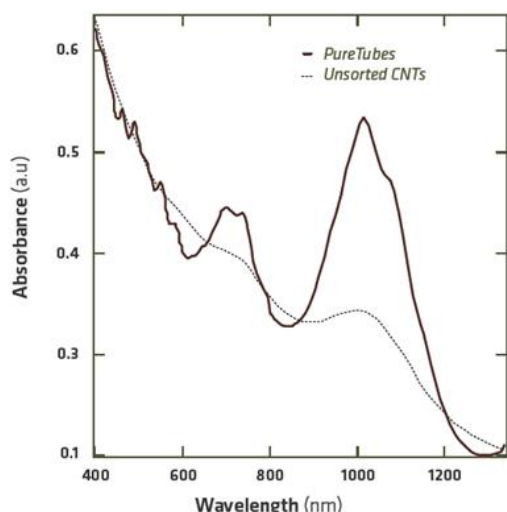


Owing to their processability, stability, and high conductivity, carbon nanotubes have received significant attention from electronics-industry researchers over the past several years as an alternative to ITO. However, development work with nanotubes has been largely precluded by the unavoidable electronic polydispersity of as-grown CNTs. NanoIntegris has effectively solved this polydispersity problem—by separating as-grown nanotubes via DGU, we can produce large quantities of uniform metallic CNTs with up to 99% purity

Unseparated Arc-Discharge SWCNT

Description: These SuperPure Tubes single-wall carbon nanotubes are purified to values of 95-98% (nanotube content measured via optically, thermogravimetrically, and by elemental analysis). PureTubes offer metal content lower than 5% and SuperPureTubes offer less than 2% metal content. These are some of the world's highest purity un-sorted nanotubes, as sourced from the arc-discharge processes and has been utilized in numerous research efforts. The product is offered in solution or thick film form.

Specifications:



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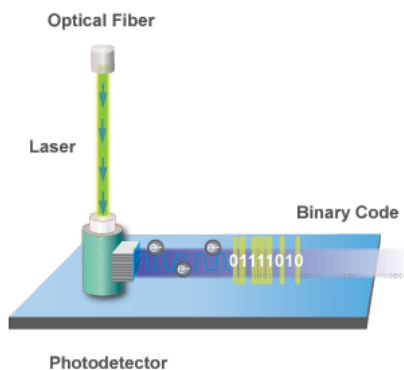
Parameter	PureTubes	SuperPureTubes
G/D ratio from Raman	> 30	> 30
Metal content from TGA	< 4%	1%
Length range from AFM	0.1-4 μm	0.1-4 μm
Carbon impurities	<5%	<5%
Diameter range	1-1.7 nm	1-1.7 nm
Itkis index from Optical Absorbance	> 0.2	> 0.2

Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1301	Super PureTubes Solution	\$200	25
1302	Super PureTubes Thick Film	\$275	25
1303	PureTubes Solution	\$75	25
1304	PureTubes Powder	\$125	25
1305	P2 Powder	\$350	1,000
1306	AP Powder	\$135	3,000
1307	COOH-Functionalized P2	\$1,000	1,000
1308	COOH-Functionalized AP	\$750	1,000

Significant discounts are available for large size orders. Please contact our sales team for a special quote.

Did you know?



Photonic devices are widely used for optical communications, spectroscopy, and precision surgery (e.g. medical lasing). Materials which exhibit strong nonlinear electro-optical behaviors are required for most photonic applications. Ideally, these materials should exhibit fast response times, absorb over a broad wavelength range, and exhibit low optical loss. Nanotubes are one of a handful of materials in existence which satisfy these property requirements.

2020 Product Catalog

Product Kits

Description: Hundreds of researchers publish groundbreaking research using our tubes every year (over 1,300 publications as of January 2020). Make sure the next major paper published in Nature, JACS, ACS Nano or Nano Letters is yours! If you are starting a new project and you are not sure which nanotube product will perform best, try a starter kit, sample or premium kit and make sure to save over 60% of the retail price if items were sold separately.

Starter kits include: **2 mg of IsoNanotubes 90%-M**
 2 mg of IsoNanotubes 90% - S
 50 mg of PureTubes

Sample kits include: **2 mg of IsoNanotubes 70%-M, 2 mg of IsoNanotubes 90%-M**
 2 mg of IsoNanotubes 90% - S, 2 mg of IsoNanotubes 95%-S
 100 mg of PureTubes

Premier kits include **1 mg of IsoNanotubes 99%-M, 1 mg of IsoNanotubes 98%-M**
 1 mg of IsoNanotubes 99% - S, 1 mg of IsoNanotubes 98%-S
 50 mg of PureTubes.

Specifications: see section above for specifications of IsoNanotubes – M, IsoNanotubes – S and PureTubes.



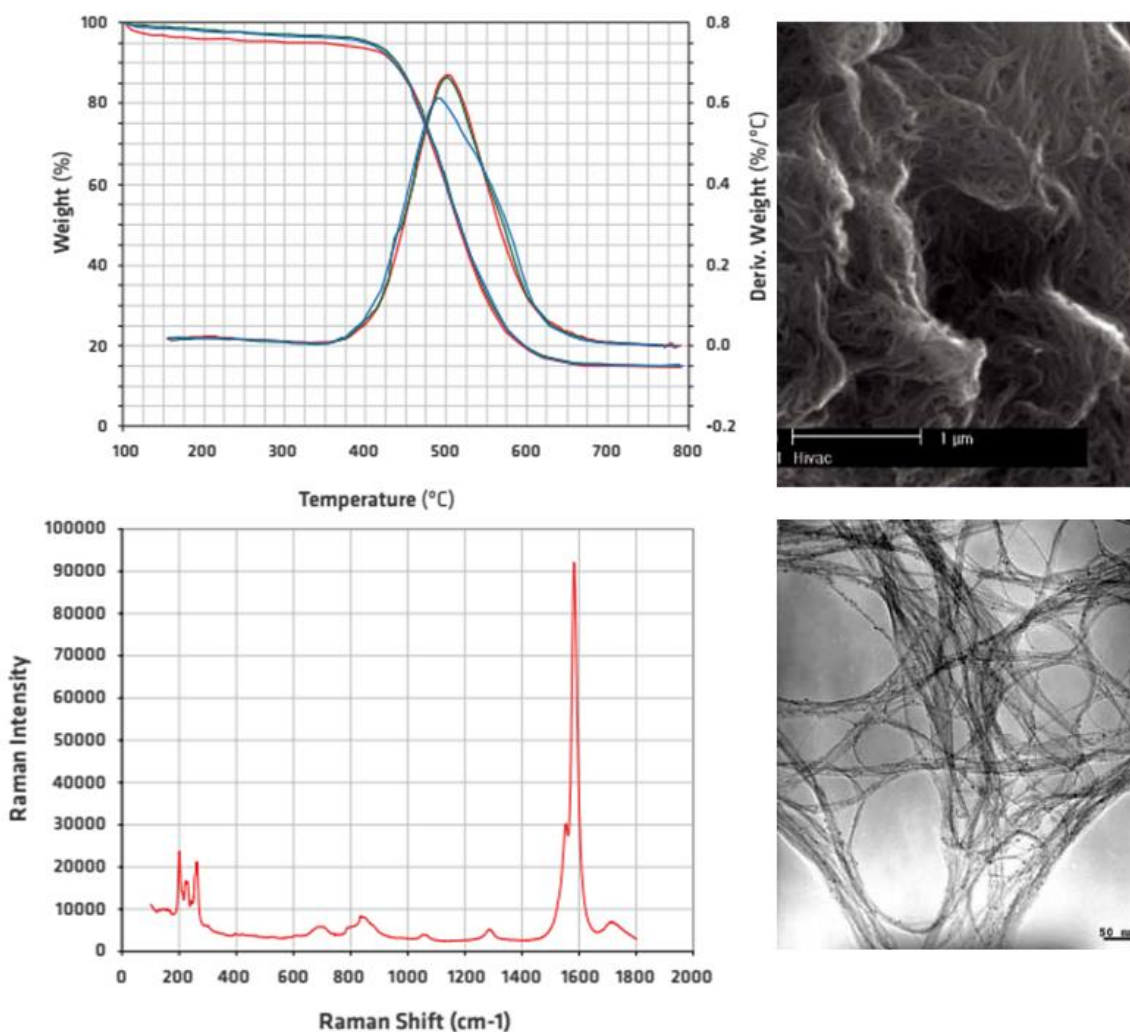
Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1401	Starter Aqueous Solution	\$899	See above
1402	Starter Powder	\$949	See above
1403	Sample Aqueous Solution	\$699	See above
1404	Sample Powder	\$749	See above
1405	Premier Aqueous Solution	\$399	See above
1406	Premier Powder	\$449	See above

HiPco Small Diameter SWCNT

Description: HiPco SWCNT represent a benchmark for small diameter nanotubes both in the academic community and for industrial and commercial applications. They are synthesized in the original fluidized bed process developed by Nobel laureate Professor Richard Smalley and located at Rice University. We offer three grades of purity for this unique material. Raw HiPco SWCNT contain up to 15% of iron, whereas Purified HiPco SWCNT and Superpurified HiPco SWCNT contain less than 10 and 5% iron respectively.

Specifications:



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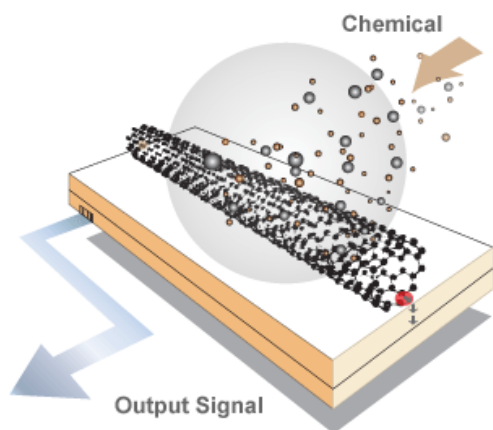
Parameter	Raw	Purified	SuperPurified
Residual Iron Content	<35%	<15%	<5%
Length	0.1-1 μm	0.1-1 μm	0.1-1 μm
Diameter	0.8-1.2 nm	0.8-1.2 nm	0.8-1.2 nm

Prices:

SKU#	Product	Price (USD)	Quantity (g)
1601	Raw Fluffy Powder	\$500	1.0
1602	Raw Wet Cake	\$525	1.0
1603	Purified	\$700	1.0
1604	Super Purified	\$1,800	1.0

Significant discounts are available for large size orders. Please contact our sales team for a special quote.

Did you know?

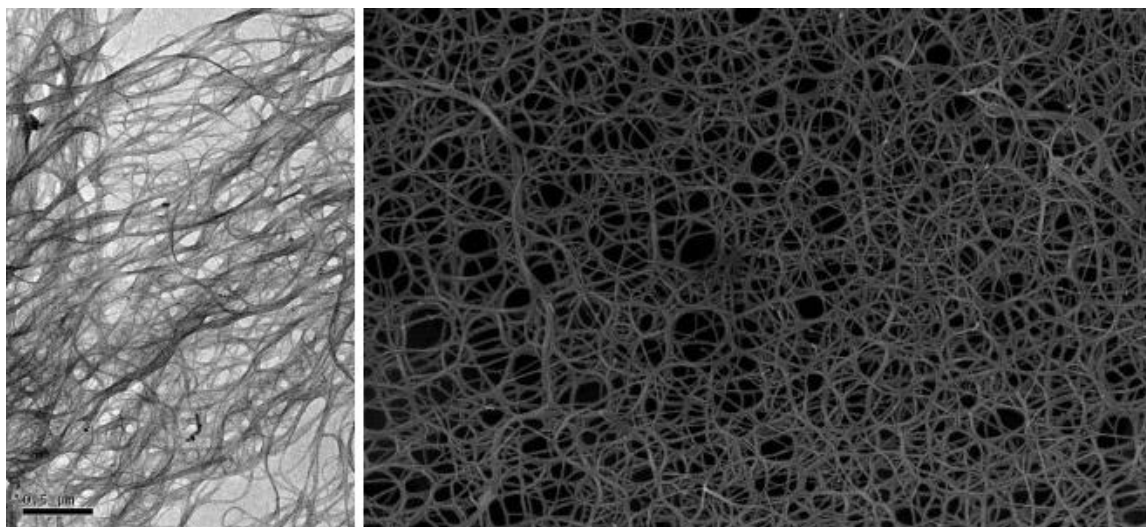


Chemical sensors are used for many purposes, such as environmental hazard screening, explosives detection, product characterization, and medical testing. The electronic properties of SWNTs can change significantly when gases and bio-molecules are adsorbed to their surface. These changes can be detected in resistor, transistor, or capacitor devices. A principle advantage of TFT SWNT sensors in particular is that they respond to analyte surface coverage, as opposed to conventional sensors, which respond to analyte concentration.

HiPco(β): Small Diameter SWCNT

Description: NanIntegris is very proud to offer a new grade of HiPco SWCNT. These small diameter single-wall carbon nanotubes are synthesized using the high-pressure carbon monoxide process developed at Rice University. A new reactor, recently launched, produces the same material, but at a different location and at larger scale.

Specifications:



Metric	Value	Method of Analysis
Diameter	0.6 – 1.1 nm	Raman, TEM
Length	400 – 700 nm	TEM
Color	Black	-
Ash content of Raw SWCNT	< 10 wt%	TGA
Ash content of Purified SWCNT	< 1 wt%	TGA
Carbon Purity	> 90%	TGA
Average G/D Ratio	~ 35	Raman (514 nm)

Prices:

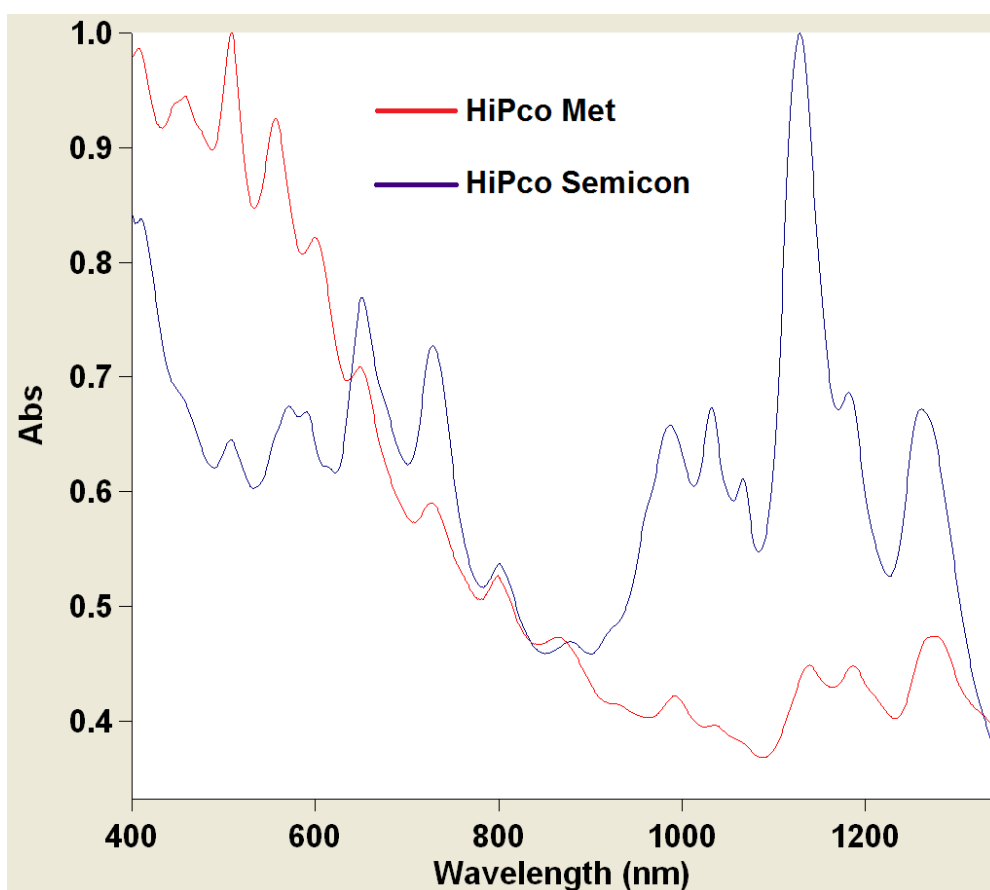
SKU#	Product	Price (USD)	Quantity (g)
1613	HiPco(β) SWCNT - Raw	\$299	1.0
1614	HiPco(β) SWCNT - Purified	\$549	1.0

Significant discounts are available for large size orders. Please contact our sales team for a special quote.

HiPco Semiconducting/Metallic Sorted SWCNT

Description: The Enriched Semiconducting and Metallic HiPco products combine the techniques for generating our highly successful IsoNanoubes-M and S product lines along with the extensively utilized small-diameter HiPco starting material. Boasting a final product purity that is >90% semiconducting or metallic in nature, this material is certain to enable the creation of numerous electronic applications such as flexible thin film transistors, gas detectors, CMOS circuits, and highly conductive metal composites.

Specifications:



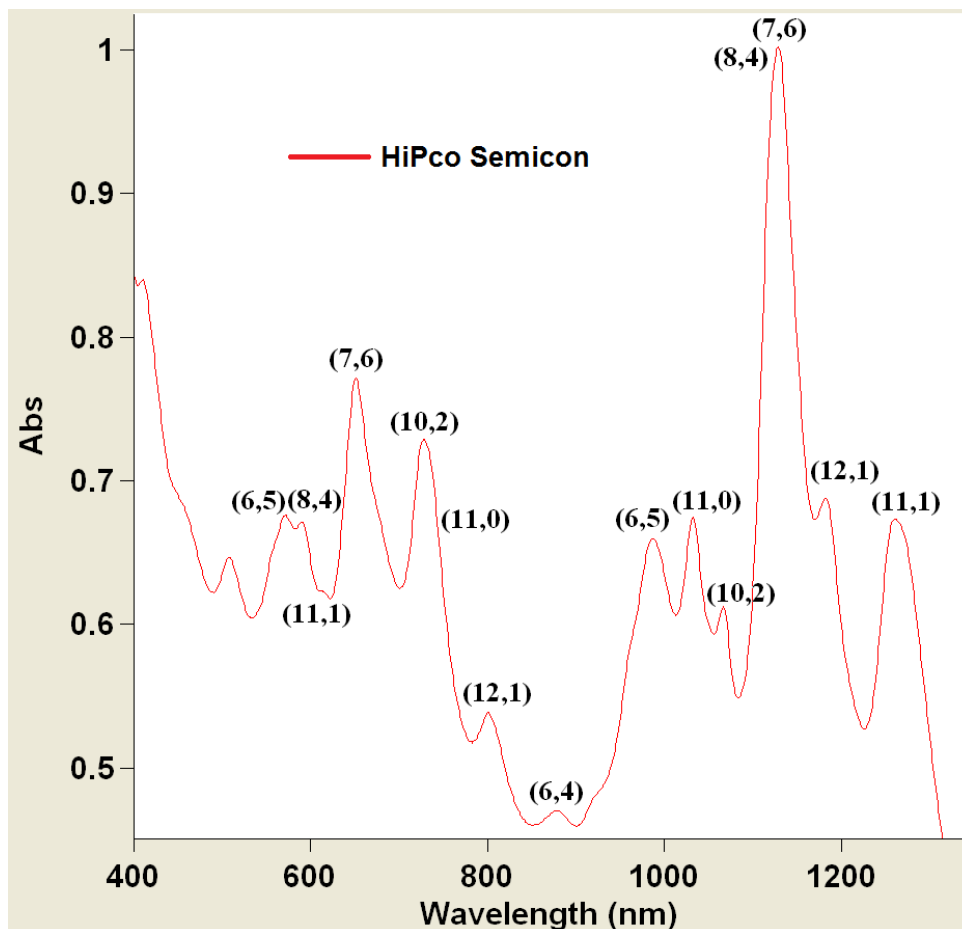
Product	Semiconducting Enrichment	Metallic Nanotube Content	Diameter	Residual Fe Catalyst
HiPco Semiconducting SWCNT	>98%	<2%	0.8-1.2nm	<5% by weight
HiPco Metallic SWCNT	<5%	>95%	0.8-1.2nm	<5% by weight

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Prices:

SKU#	Product	Price (USD)	Quantity (g)
1605	Metallic Enriched Aqueous Solution	\$599	1.0
1606	Metallic Enriched Powder	\$649	1.0
1607	Semiconducting Enriched Solution	\$499	1.0
1608	Semiconducting Enriched Powder	\$549	1.0

Significant discounts are available for large size orders. Please contact our sales team for a special quote.

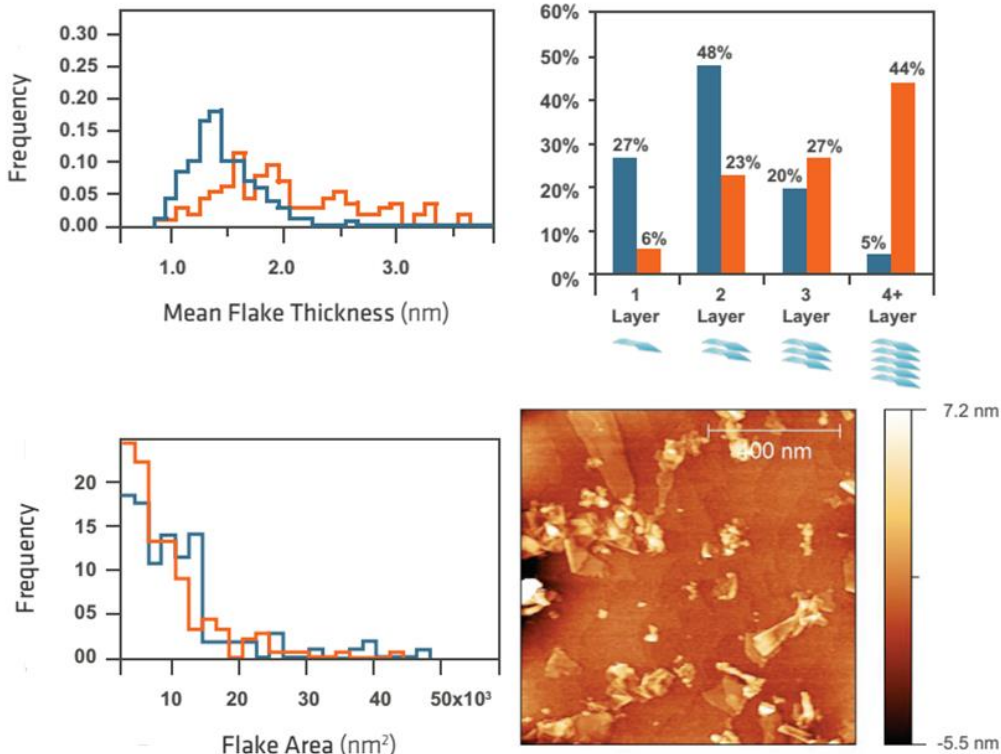
PureSheets: 1-4 Layer Graphene Nanoplatelets

Description: PureSheets graphene nanoplatelets (GNP) were mechanically exfoliated from graphite. Our graphene solutions are post-processed to remove thicker platelets that were not properly exfoliated. This step ensures the optimal dispersion and stability of our products. PureSheets-MONO GNP contain, on average, 1-3 graphene layers according to AFM while PureSheets-QUATTRO contain, on average, 4-6 layers of graphene.

Specifications:



- MONO Grade
- QUATTRO Grade



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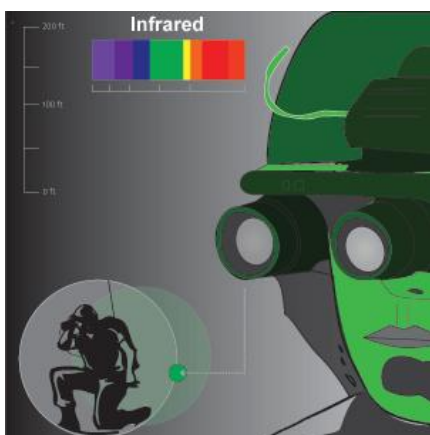
Parameter	MONO	QUATTRO	Measurement
Single Layer Content	27%	6%	AFM
Double Layer Content	48%	23%	AFM
Triple Layer Content	20%	27%	AFM
4+ Layer Content	5%	44%	AFM
Average Flake Area	10000 nm ²	10000 nm ²	AFM
Solution Type	Acqueous	Acqueous	n/a
Graphene Concentration	0.05 mg/ml	0.05 mg/ml	n/a
Surfactant Concentration	2% w/v	2% w/v	n/a

Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1701	MONO Aqueous Solution	\$100	10
1703	QUATTRO Aqueous Solution	\$75	10

Significant discounts are available for large size orders. Please contact our sales team for special quote.

Did you know?



Large-diameter semiconducting SWNTs are good absorbers and emitters of light in the infrared. Moreover, high-purity SWNT thin films have been demonstrated to be photoconductive and photo-luminescent under NIR illumination.

IR sensors/emitters are useful for a number of military and civilian applications.

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PureWave Graphene

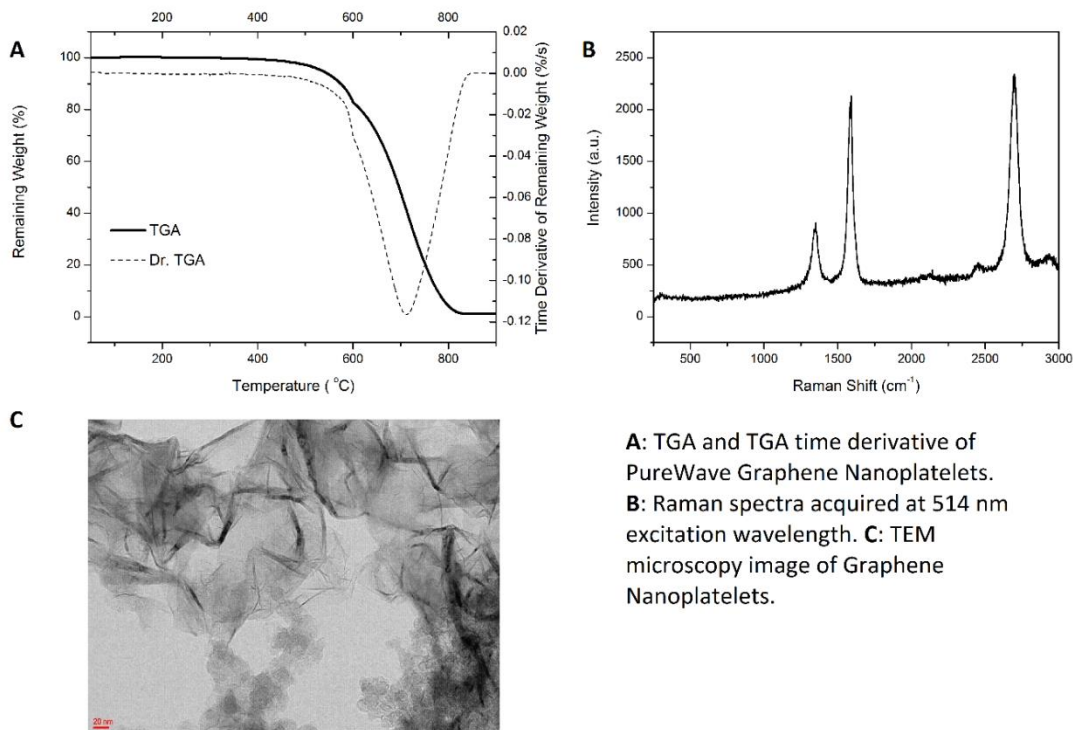
Description: Our PureWave Graphene Nanoplatelets (GNP) material is composed of thin, highly dispersible graphene nanoplatelets with very low oxygen and PAH content. The turbostratic and wavy morphology of the material leads to an unequalled ability to be dispersed in a variety of solvents and resins. Furthermore, the unique RF plasma process used to grow our PureWave Graphene Nanoplatelets is easy to scale and thus produces a low cost product. Our unique and protected growth process based on plasma enables us to produce this material at over 200g/hr, enabling commercial graphene applications such as energy storage and conductive inks as well as elastomers and resins.



Further reading: *Types and Applications of Graphene: Introducing PureWave Plasma GNPs*. N. Vanier et al. (2014) <https://www.printedelectronicsworld.com/articles/10940/types-and-applications-of-graphene-introducing-purewave-plasma-gnps>

Specifications:

Physical Characterization	
Parameter	Value
G/D ratio from Raman (514 nm)	3
2D/G ratio from Raman	0.8-1
BET Specific Surface Area	> 400 m ² /g
Average Number of Layers	6
Flake Size	150-200 nm
Oxygen Content	1%
Average Flake Thickness	2.4 nm
Carbon Content (TGA)	> 98%
Metal Impurities (ICP-MS)	< 300 ppm
Performance in Formulation (screen printed)	
Parameter	Value
Resistivity (Ω/□/mil)	1.0 - 5.0



A: TGA and TGA time derivative of PureWave Graphene Nanoplatelets. **B:** Raman spectra acquired at 514 nm excitation wavelength. **C:** TEM microscopy image of Graphene Nanoplatelets.

Prices:

SKU#	Product	Quantity (g)	Powder (USD)	Dispersion (USD)
1708	PureWave Graphene Nanoplatelets	2	\$100	\$160
1708	PureWave Graphene Nanoplatelets	10	\$250	\$400
1708	PureWave Graphene Nanoplatelets	100	\$1,500	\$2,400

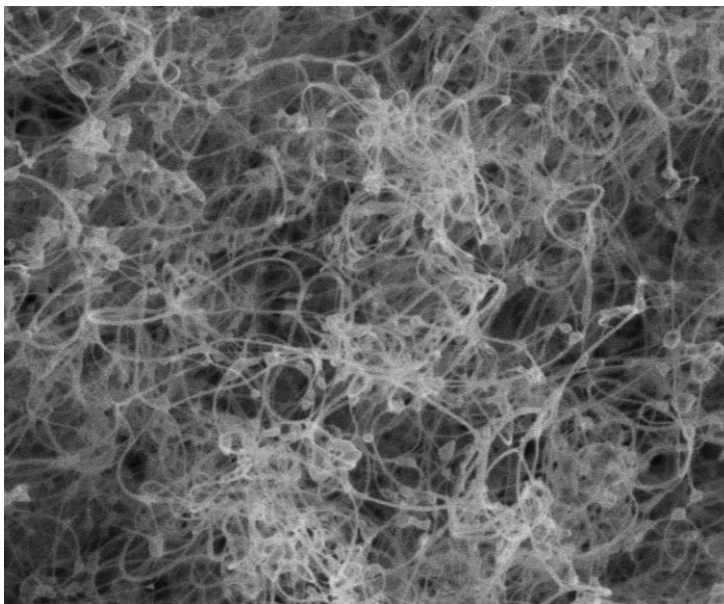
Significant discounts are available for large size orders. Please contact our sales team for a special quote.

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PlasmaTubes SWCNT

Description: Using a patented radio frequency plasma torch process, Raymor Nanotech produces raw single-wall carbon nanotubes (SWCNT) at high rates, enabling the lowest prices on the market. As shown by the detailed analysis below, plasma-grown SWCNT display a high graphitization level, diameters (0.9-1.5 nm) and lengths (0.3-4 μm) close to those of laser- and arc-grown SWCNT. The purity of the raw SWCNT (RN-020) is comparable to the purity of the best arc-discharge SWCNT on the market. The following sections will display the information gathered by thermogravimetric analysis, Raman spectroscopy and optical absorption on the raw (RN-020), purified (RN-220) and SuperPurified (SPT-220) SWCNT. The Super Purified SWCNT (SPT-220) product has a nanotube purity of 95-99%. This material is provided in an aqueous surfactant solution with a nanotube concentration of 0.50 mg/ml or a surfactant-removed thick film. Regarding the difference between RN-020, and RN-000 raw SWCNT, the first are grown using a Co-Fe-Ni catalyst mixture whereas the latter are grown using a Ni-Y catalyst mixture. Unless requested, RN-020 is used for all purified and separated grades.

Specifications:



Parameter	Measurement for RN-020 & RN-000	Typical range
G/D ratio with BWF subtraction	Raman spectroscopy at 514 nm	> 35
G/D ratio without BWF subtraction	Raman spectroscopy at 514 nm	> 30
Ash content	Thermogravimetric analysis	27%
1st oxidation peak	Thermogravimetric analysis	400 °C
2nd oxidation peak	Thermogravimetric analysis	690 °C
Itkis index	Optical absorption	0.06-0.08
Carbon Purity	Thermogravimetric analysis	80-85%

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Parameter	Measurement for RN-220	Typical range
G/D ratio with BWF subtraction	Raman spectroscopy at 514 nm	> 80
G/D ratio without BWF subtraction	Raman spectroscopy at 514 nm	> 70
Ash content	Thermogravimetric analysis	21%
1st oxidation peak	Thermogravimetric analysis	580 °C
2 nd oxidation peak	Thermogravimetric analysis	650 °C
Itkis index	Optical absorption	0.08-0.1

Parameter	Measurement for SPT-220	Typical range
G/D ratio with BWF subtraction	Raman spectroscopy at 514 nm	> 40
G/D ratio without BWF subtraction	Raman spectroscopy at 514 nm	> 35
Ash content	Thermogravimetric analysis	1-3%
1st oxidation peak	Thermogravimetric analysis	580 °C
2 nd oxidation peak	Thermogravimetric analysis	650 °C
Itkis index	Optical absorption	> 0.2

Prices:

SKU#	Product	Price (USD)	Quantity
1801	Super Purified Plasma Solution	\$200	25mg
1802	Super Purified Plasma Thick Film	\$275	25mg
1803	Purified Powder (e.g. RN-220)	\$275	1.0 g
1804	Semi-Purified Powder (e.g. RN-120)	\$185	1.0 g
1805	Raw Powder (e.g. RN-020)	\$100	3.0 g

NOTE: All Super Purified, Purified, Semi-purified, and Raw powders can be provided with RN-000 or RN-020 as the source material. The default source material is RN-020.

Significant discounts are available for large size orders. Please contact our sales team for a special quote.

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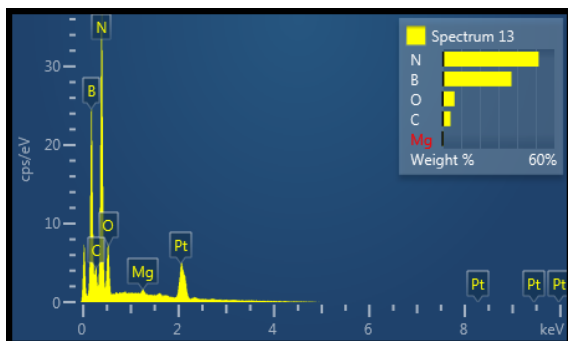
Boron Nitride Nanotubes: Multi-walled Powder

Description: BNNT presents similar thermal conducting and mechanical properties compared to carbon nanotubes, but its thermal/chemical stabilities, biocompatibility, electric insulating, and thermal neutron absorbing properties are much higher than those of CNTs. Due to these superior properties, BNNT is currently under exploration in many areas of IT, space/nuclear, bio-medical, and energy. The primary usage for BNNT is to have the material serve as a Thermal Conductor. The thermal conductivity of a material can be multiplied by the incorporation of BNNT within composite materials. Along with this, BNNT-MWs can also provide Electrical Insulation to materials utilized for information technology devices.

Specifications:



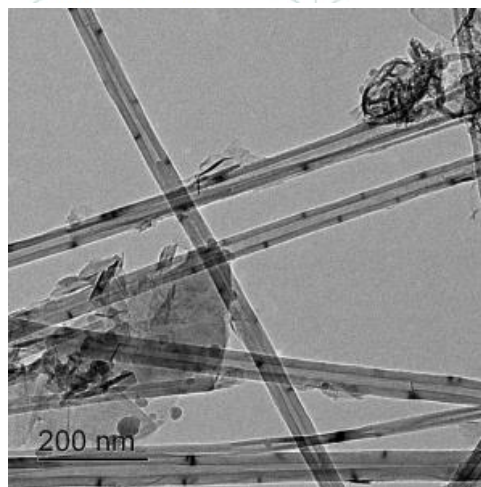
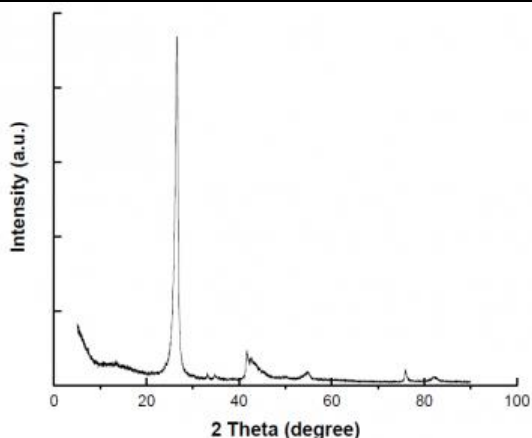
Characteristic	CNT	BNNT
Electrical properties	Metallic or semiconducting	Always semiconducting (>5 eV wide band gap)
Thermal oxidation resistance	Stable up to 300–400°C in air	Stable up to 800°C in air
Thermal neutron absorption(b = 10-24 m2)	0.0035b	B ~760b / N ~1.9b
Thermal conductivity	60 ~ 40,000 W/mK	~3,000 W/mK (Cu ~400 W/mK)
Mechanical properties (Young's modulus)	1.33 TPa	1.18 TPa
Coefficient of Thermal Expansion	~1 x 10 ⁻⁶	~1 x 10 ⁻⁶
Color	black	White (grey if impurity exists)



Element	Line Type	Wt%	Atomic %
B	K series	36.96	43.32
C	K series	4.31	4.55
N	K series	51.59	46.67
O	K series	6.46	5.12
Mg	K series	0.67	0.35
Total:		100.00	100.00

Stoichiometry of BNNT after scanning random area

→ B : N = 43.3 : 46.7 (~1:1)



PURITY	>70%	>90%
BET Surface Area	32.90 m ² /g	~50 m ² /g
Molecular Cross-Sectional	0.1620 nm	—
Diameter	50-100 nm	50nm
Length	~9 μm	>10 μm

Prices:

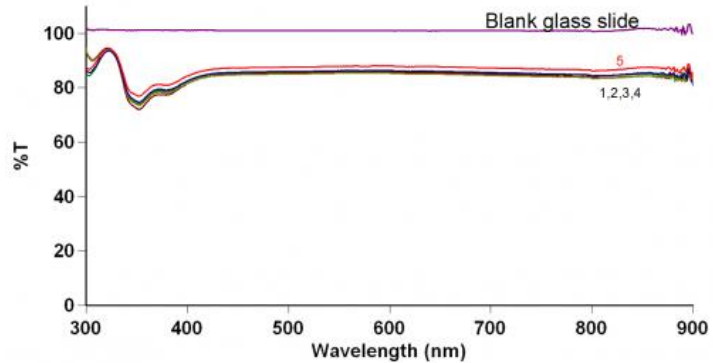
SKU#	Product	Price (USD)	Quantity (g)
1901	>70% Pure BNNT Powder	\$650	1.0
1907	>90% Super Pure BNNT Powder	\$1,200	1.0

Discounts are available for large size orders. Please contact our sales team for a special quote.

Silver Nanowire Ink for Transparent Conductive Film

Description: We offer a new high performance silver nanowire ink for transparent conductive film applications. Our highly conductive transparent ink works can be coated with slot die coating and micro-gravure coating, along with other application techniques.

Specifications:



Performance Index	Testing method	Testing Result
AgNW diameter / length	TEM / SEM	30nm / 20µm
Appearance	Visual	Gray suspension
AgNW content (wt%)	Wet Combustion Method	0.2 - 0.3
Density (g/ml)	Densimeter	1.05
Viscosity (cps) @ 25°C	Rotor rotational viscometer	5 -30 cps
Curing temperature	130°C for 3-5 min	
Sheet resistance (Ω/\square)	Four Probe Method	50 - 100
Transmittance (%)	WGW	90 - 91
Haze (%)	WGW	1 - 1.5
Surface hardness (H)	Pencil hardness testing device	2 - 3H
Adhesion	3M 600 tape, pull vertically	Not shed

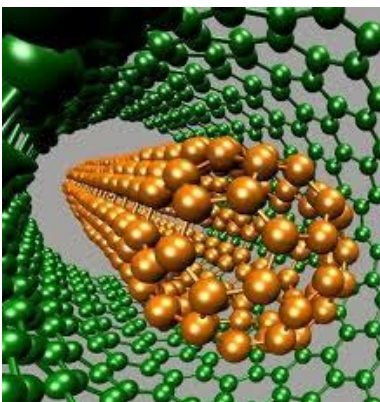
Prices:

SKU#	Product	Price (USD)	Quantity
2004	TCF-30 Silver Nanowire Ink	\$350	1 g / 100 ml

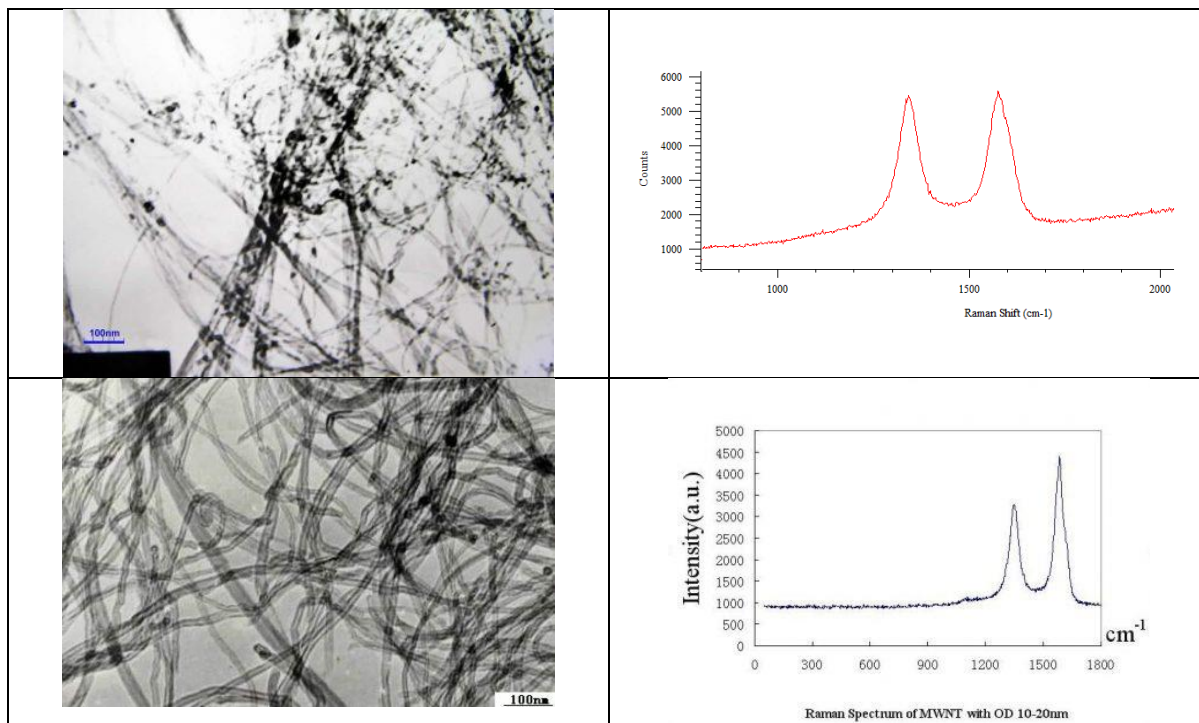
Discounts are available for large size orders. Please contact our sales team for a special quote.

Double and Multi-Walled Carbon Nanotubes (MWCNT)

Description: Multi-walled carbon nanotubes (MWCNT) are the ideal filler for the structural reinforcement or improvement in electrical conductivity of polymers, elastomers and epoxy. These CVD-grown nanotubes display high purity and low metal content, a controlled diameter range, good length and aspect ratio but most importantly are priced to suit both research and industrial needs.



Specifications:



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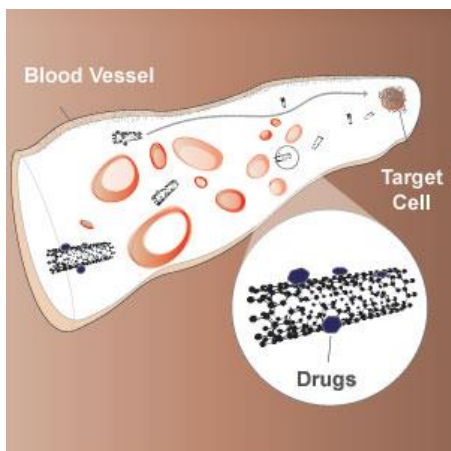
Parameter	99% Purity MWNT	<8 nm MWNT	10-20 nm MWNT
MWNTs Outer Diameter	<20nm	<8 nm	10-20 nm
MWNTs Inside Diameter	4nm	2-5 nm	3-5 nm
MWNTs Ash	0 wt%	<1.5 wt%	<1.5 wt%
MWNTs Purity	>99 wt%	>95 wt%	>95 wt%
WNTs Length	1-12µm	10-30 µm	10-30 µm
Source Material	CVD	CVD	CVD
MWNTs Specific Surface Area	n/a	500 m ² /g	233 m ² /g
MWNTs Electrical Conductivity	n/a	>100 S/cm	>100 S/cm
MWNTs Bulk density	n/a	0.27 g/cm ³	0.22 g/cm ³
MWNTs True density	n/a	~2.1 g/cm ³	~2.1 g/cm ³

Prices:

SKU#	Product	Price (USD)	Quantity (g)
2117	99%, Powder	125	5
2103	95%, <8nm OD Powder	65	5
2105	95%, 10-20nm OD Powder	50	5

Discounts are available for large size orders. Please contact our sales team for a special quote.

Did you know?



CNTs have proven useful for targeted drug delivery. Anti-cancer drugs may be delivered more efficaciously and with fewer systemic side-effects using a "smart" nanotechnology platform than by conventional methods. Carbon nanotubes represent one such promising platform, due to their strong absorbance in the so-called therapeutic infrared window (between 700-1100 nm, depending on body tissue type).

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Services

Description: Take advantage of our 11 years of expertise in the nanotechnology and nanotubes industry as an ISO 9001 Certified company! Raymor and NanoIntegris constitute one of the world’s largest and most trusted providers of single-walled carbon nanotubes and nanomaterials in general. We have produced, purified, separated, functionalized and dispersed nanotubes using the best methods in a variety of media and solvents while scaling each process significantly. Please contact us for any special projects or inquiries. It will be our pleasure to provide you with the simplest and most cost effective solution. The following list is a subset of available services so please do not hesitate to contact us for your special requirements.



Prices:

SKU#	Product	Price (USD)
2201	Powder/ Thick Film Creation	Ask for quote
2202	Dispersion: Aqueous Solution	Ask for quote
2203	Dispersion: Non-Aqueous Solution	Ask for quote
2204	Small-scale Testing	Ask for quote
2205	Production Scale-up	Ask for quote
2206	Product Development/ R&D	Ask for quote
2207	Scientific Consultation	Ask for quote
2209	Solution Processing	Ask for quote



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