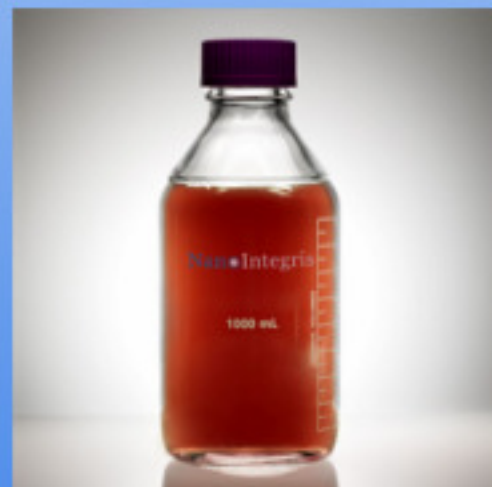
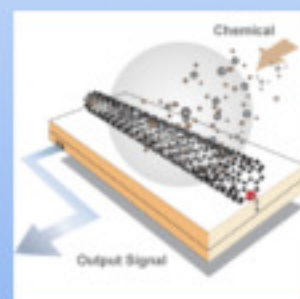
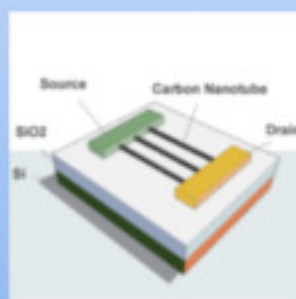


# RAYMOR NanoIntegris

## 2016 CATALOG



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# **RAYMOR** NanoIntegris

## **2016 Product Catalog**

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 10 years, Raymor Industries has developed its plasma processing capability which led to the marketing of two outstanding products: plasma-grown single-wall carbon nanotubes (SWCNT) and plasma-atomized spherical titanium powder.

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 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.

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Tel: +81-3-5202-5624
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## Table of Contents | Product List

Item   SKU#	PRODUCT	Page
<b>1100</b>	<b>IsoNanotubes-S and IsoSol-S: Semiconducting Single-Wall Carbon Nanotubes (SWNT)</b>	<b>6</b>
1101	99% Aqueous	6
1102	99% Powder	6
1103	98% Aqueous	6
1104	98% Powder	6
1105	95% Aqueous	6
1106	95% Powder	6
1107	90% Aqueous	6
1108	90% Powder	6
1109	(12,8) Chirally-Enriched Aqueous	6
1110	(12,8) Chirally-Enriched Powder	6
1111	100% IsoSol-S100 Polymer Wrapped Powder	6
1112	100% IsoSol-S100 Aromatic Solution	6
1115	99.9% Aqueous	6
1116	99.9% Powder	6
1117	(6,5) Chirally Enriched Solution	6
1118	(6,5) Chirally Enriched Powder	6
<b>1200</b>	<b>IsoNanotubes-M: Metallic SWNTs</b>	
1201	99% Aqueous	8
1202	99% Powder	8
1203	98% Aqueous	8
1204	98% Powder	8
1205	95% Aqueous	8
1206	95% Powder	8
1207	90% Aqueous	8
1208	90% Powder	8
1209	70% Aqueous	8
1210	70% Powder	8
<b>1300</b>	<b>Unseparated Arc-Discharge SWNTs</b>	<b>10</b>
1301	Super PureTubes:Aqueous	10
1302	Super PureTubes: Powder	10
1303	PureTubes: Aqueous	10
1304	PureTubes: Powder	10
1305	P2 Powder	10
1306	AP Powder	10
1307	COOH-Functionalized P2	10
1308	COOH-Functionalized AP	10

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**NanoIntegris**  
**2016 Product Catalog**

	<b>Overview of SWNT Properties</b>	<b>12</b>
1400	<b>Product Kits</b>	<b>13</b>
1401	Starter Aqueous	13
1402	Starter Powder	13
1403	Sample Aqueous	13
1404	Sample Powder	13
1405	Premier Aqueous	13
1406	Premier Powder	13
1600	<b>HiPco Small Diameter SWNTs</b>	<b>14</b>
1601	Raw Fluffy Powder	14
1602	Raw Wet Cake	14
1603	Purified	14
1604	Super Purified	14
1605	Metallic Enriched Aqueous	14
1606	Metallic Enriched Powder	14
1607	Semiconducting Enriched Aqueous	14
1608	Semiconducting Enriched Powder	14
1611	COOH-Functionalized	14
1700	<b>PureSheets: 1-4 Layer Graphene Nanoplatelets</b>	<b>16</b>
1701	MONO Aqueous	16
1702	MONO Powder	16
1703	QUATTRO Aqueous	16
1704	QUATTRO Powder	16
1705	Graphite (non-exfoliated) Powder	16
1706	Graphene oxide	16
1707	Conductive Graphene Nanoplatelets	16
1800	<b>Unseparated Plasma SWNTs</b>	<b>18</b>
1801	Super Purified (SPT-220) Aqueous	18
1802	Super Purified (SPT-220) Powder	18
1803	Semi-Purified (RN-220) Aqueous	18
1804	Semi-Purified (RN-220) Powder	18
1805	Air-Oxidized (RN-120) Aqueous	18
1806	Air-Oxidized (RN-120) Powder	18
1807	Raw (RN-020) Aqueous	18
1808	Raw (RN-020) Powder	18
1809	Raw (RN-000) Aqueous	18
1810	Raw (RN-000) Powder	18
1900	<b>Boron Nitride Nanotubes (BNNT)</b>	<b>20</b>
1901	BNNT Powder	20
1902	BNNT Aqueous Solution	20
1903	Purified BNNT Aqueous Solution	20

# RAYMOR NanoIntegris

## 2016 Product Catalog

1904	Purified BNNT Powder	20
1905	Hex-Boron Nitride Flakes	20
2000	<b>Silver Nanowire Ink and Transparent Conductive Film</b>	<b>21</b>
2004	Silver Nanowire Ink	21
2100	<b>Double and Multi-Walled Carbon Nanotubes</b>	<b>22</b>
2101	99%, Powder	22
2102	99%, Solution	22
2103	95%, <8nm OD Powder	22
2104	95%, <8nm OD Solution	22
2105	95%, 10-20nm OD Powder	22
2106	95%, 10-20nm OD Solution	22
2107	90% DWNT, 5-30 $\mu$ m in length	22
2108	90% DWNT, 0.5-2 $\mu$ m in length	22
2200	<b>Services</b>	<b>24</b>
2201	Powder/ Thick Film Creation	24
2202	Dispersion: Aqueous	24
2203	Dispersion: Non-Aqueous Solution	24
2204	Small-scale Testing	24
2205	Production Scale-up	24
2206	Product Development/ R&D	24
2207	Scientific Consultation	24
2209	Solution Processing Fee	24
2300	Inks for Printed Electronics	25
2301	Xdi-dcs Dielectric Ink	25



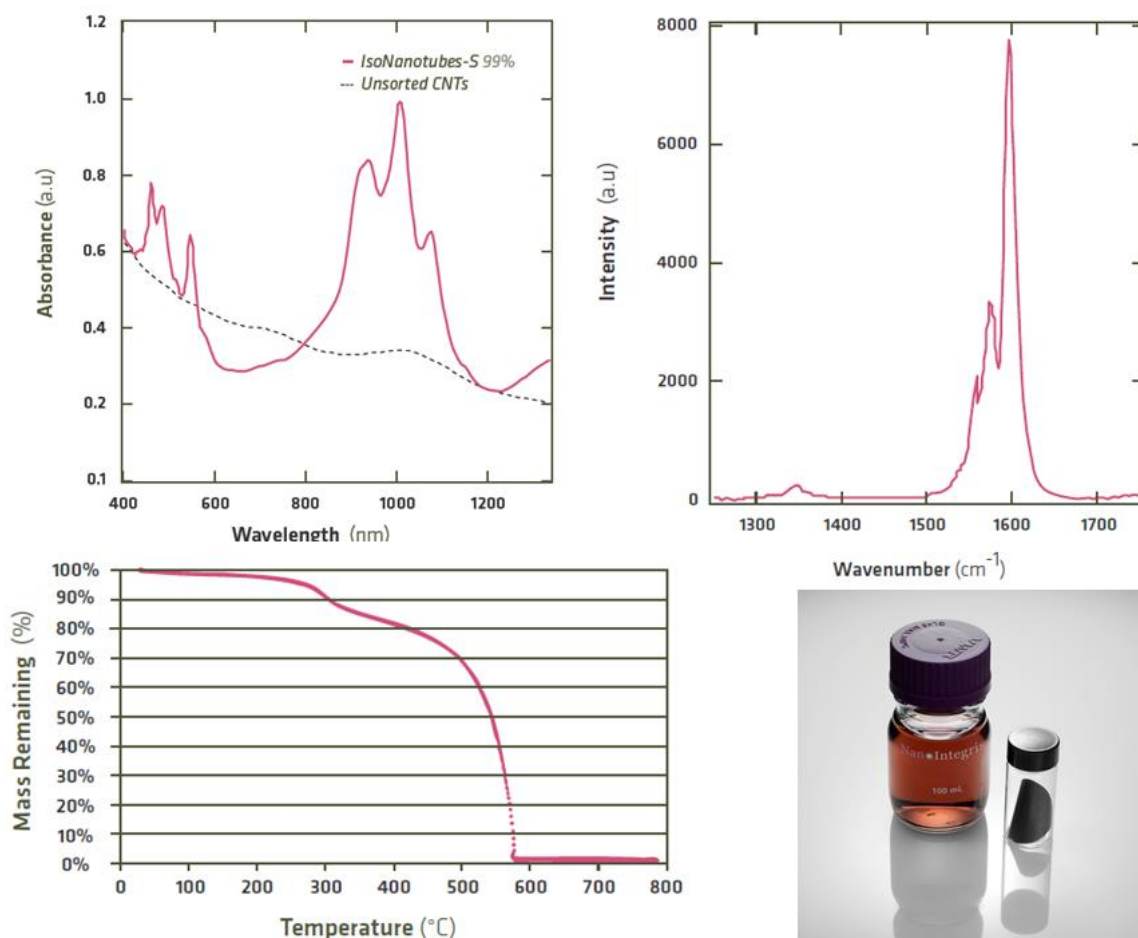


## IsoNanotubes-S and IsoSol-S: Semiconducting SWNTs

**Description:** Semiconducting single-wall carbon nanotubes are a NanoIntegris exclusivity. They are sorted using a scalable production process. Offered in an aqueous solution or a powder.

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 lead to canotube thin-film transistors (SWCNT-TFT) that deliver average mobilities of 10-20 cm<sup>2</sup>/V/s and current ON/OFF ratios of 10<sup>3</sup>-10<sup>6</sup> (on Si/SiO<sub>2</sub>) as well as average current densities of 1-10 μA/μm, sufficient in principle to drive organic light-emitting diodes (OLEDs). The semiconducting single-wall carbon nanotubes are sourced from the highly-scalable RF-plasma process, and separated using conjugated polymer extraction. Please note that SKU# 1117 and 1118 use SWCNT from the CoMoCAT process.

### Specifications:



# RAYMOR NanoIntegris

## 2016 Product Catalog

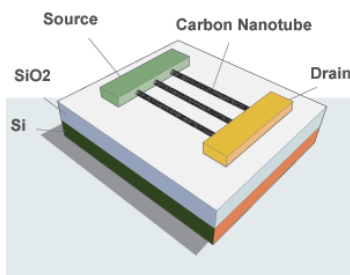
Parameter	IsoNanotubes-S
Available Purities	90%, 95%, 98%, 99% and 99.9%
Metal content from TGA	< 1%
Length from AFM	0.3-4 $\mu\text{m}$
Solvent	Water or Toluene
Diameter range	1-1.7 nm

### Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1101	IsoNanotubes-S 99% Aqueous	800	1.0
1102	IsoNanotubes-S 99% Powder	850	1.0
1103	IsoNanotubes-S 98% Aqueous	450	1.0
1104	IsoNanotubes-S 98% Powder	500	1.0
1105	IsoNanotubes-S 95% Aqueous	300	1.0
1106	IsoNanotubes-S 95% Powder	350	1.0
1107	IsoNanotubes-S 90% Aqueous	200	1.0
1108	IsoNanotubes-S 90% Powder	250	1.0
1109	(12,8) Chirally Enriched 99% Aqueous	1600	1.0
1110	(12,8) Chirally Enriched 99% Powder	1650	1.0
1111	100% IsoSol-S100 Polymer Wrapped Powder	795	1.0
1112	100% IsoSol-S100 Aromatic Solution	695	1.0
1115	IsoNanotubes-S 99.9% Aqueous	1200	1.0
1116	IsoNanotubes-S 99.9% Powder	1250	1.0
1117	(6,5) Chirally Enriched 95% Aqueous	1150	200.0
1118	(6,5) Chirally Enriched 95% Powder	1150	1.0g

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



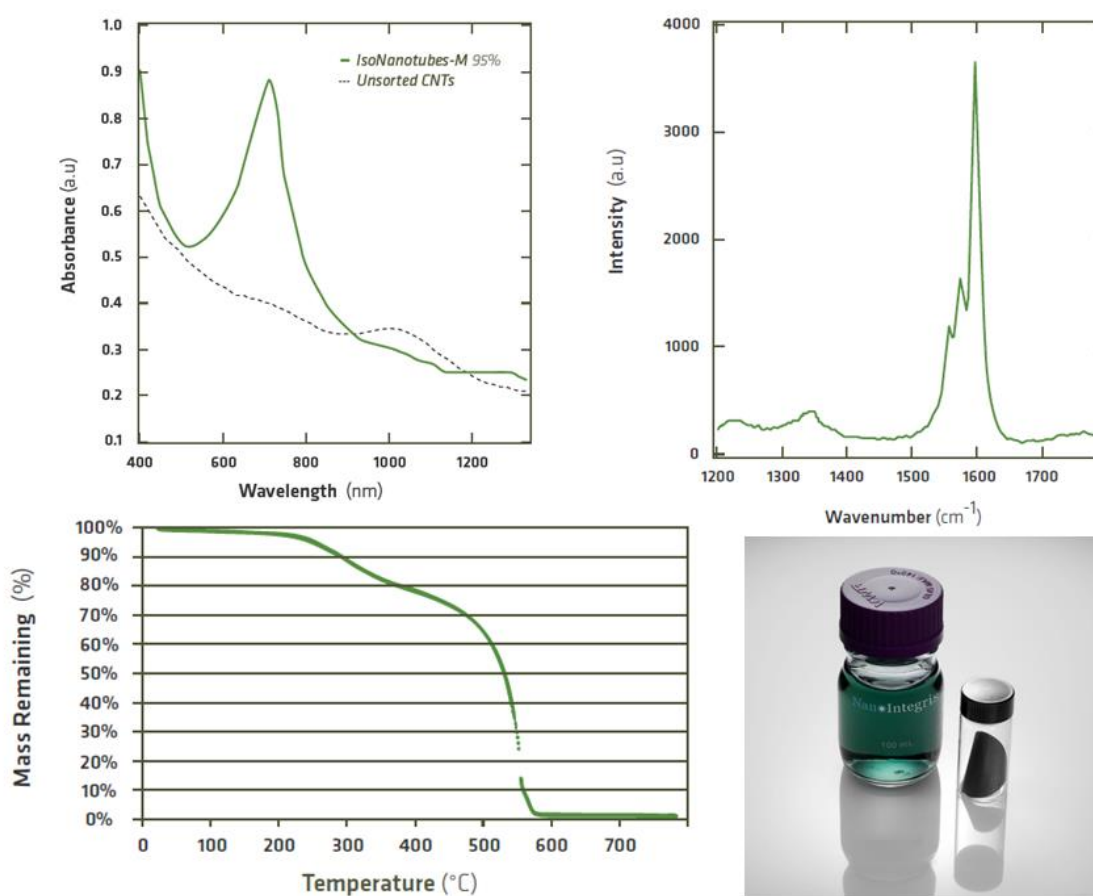
# RAYMOR NanoIntegris

## 2016 Product Catalog

### IsoNanotubes-M: Metallic SWNTs

**Description:** Metallic single-wall carbon nanotubes are a NanoIntegris exclusivity. They are sorted using our patented density gradient ultracentrifugation (DGU) process and offered in an aqueous solution or a powder.

#### Specifications:



# RAYMOR NanoIntegris

## 2016 Product Catalog

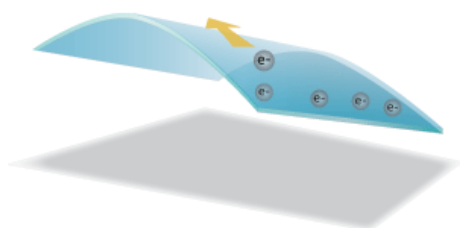
Parameter	IsoNanotubes-M
Available Purities	70%, 90%, 95%, 98% and 99%
Metal content from TGA	< 1%
Length range	0.3-4 $\mu$ m
Solvent	Water
Diameter range	1-1.7 nm

### Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1201	IsoNanotubes-M 99% Aqueous	900	1.0
1202	IsoNanotubes-M 99% Powder	950	1.0
1203	IsoNanotubes-M 98% Aqueous	700	1.0
1204	IsoNanotubes-M 98% Powder	750	1.0
1205	IsoNanotubes-M 95% Aqueous	400	1.0
1206	IsoNanotubes-M 95% Powder	450	1.0
1207	IsoNanotubes-M 90% Aqueous	300	1.0
1208	IsoNanotubes-M 90% Powder	350	1.0
1209	IsoNanotubes-M 70% Aqueous	200	1.0
1210	IsoNanotubes-M 70% Powder	250	1.0

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

## 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

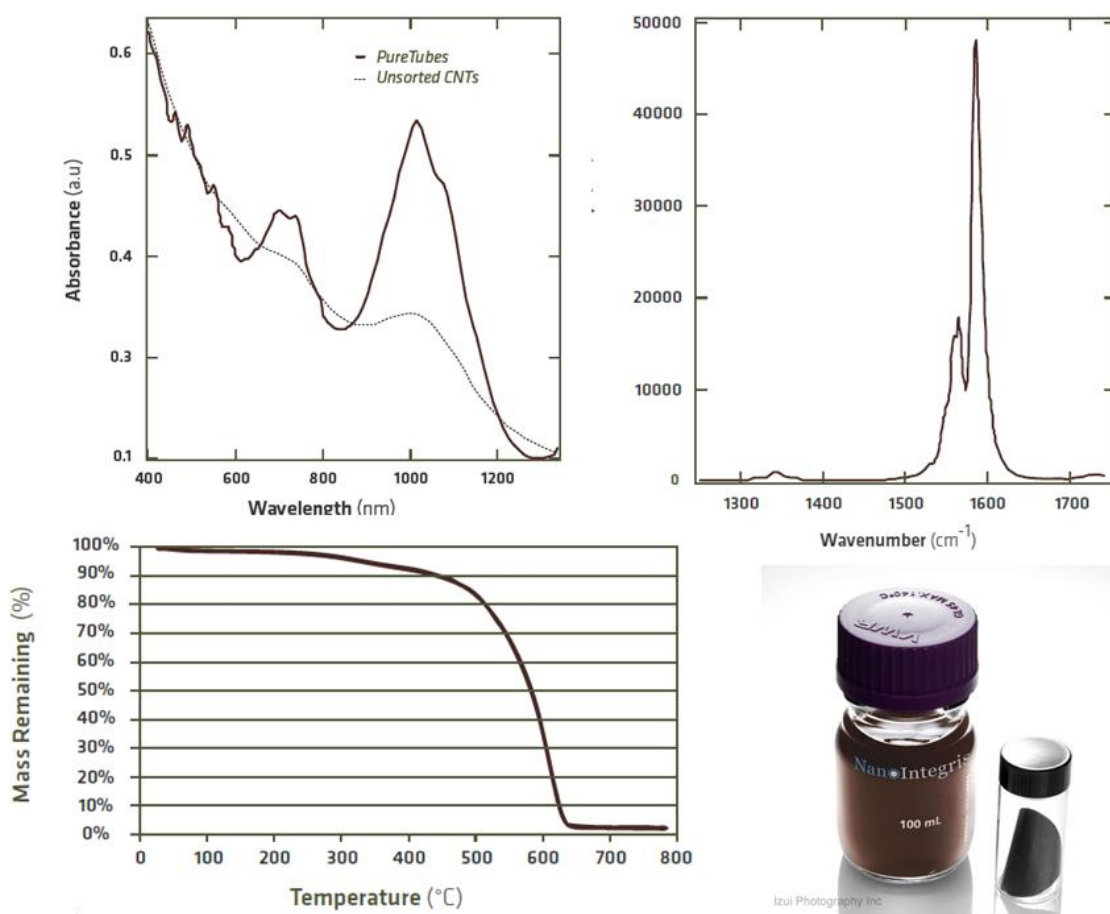
# RAYMOR NanoIntegris

## 2016 Product Catalog

### Unseparated Arc-Discharge SWNTs

**Description:** These single-wall carbon nanotubes are purified to values of 95-98% (nanotube content measured via the Itkis ratio). PureTubes offer metal content lower than 5% and SuperPureTubes offer less than 2% metal content (as per TGA). These are our highest purity un-sorted nanotubes. Sourced from the arc-discharge processes and offered in solution or dry powder.

#### Specifications:



# RAYMOR NanoIntegris

## 2016 Product Catalog

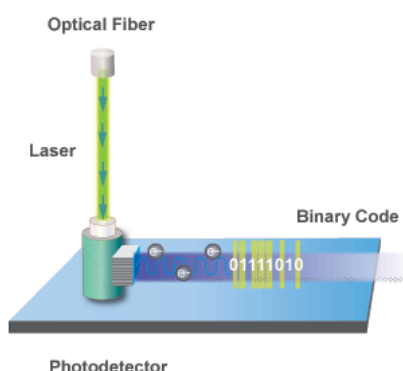
Parameter	PureTubes	SuperPureTubes
G/D ratio from Raman	> 30	> 30
Metal content from TGA	< 4%	1%
Length range from AFM	0.1-4 $\mu$ m	0.1-4 $\mu$ m
Carbon impurities	<5%	<5%
Diameter range	1-1.7 nm	1-1.7 nm
Irkis index from Optical Absorbance	> 0.2	> 0.2

### Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1301	Super PureTubes Aqueous	2500	1.0
1302	Super PureTubes Powder	2600	1.0
1303	PureTubes Aqueous	960	1.0
1304	PureTubes Powder	1060	1.0
1305	P2 Powder	350	1.0g
1306	AP Powder	135	3.0g
1307	COOH-Functionalized P2	1000	1.0g
1308	COOH-Functionalized AP	750	1.0g

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

## Overview of SWNT Properties

Property	IsoNanotubes-M	IsoNanotubes-S	PureTubes	Measurement	Set Figure	Solution	Powder
Nanotube Type	Arc discharge	Arc discharge	Arc discharge	Manufacturer data	n/a	✓	✓
Diameter Range	1.2 - 1.7 nm	1.2 - 1.7 nm	1.2 - 1.7 nm	Manufacturer data	n/a	✓	✓
Mean Diameter	1.4 nm	1.4 nm	1.4 nm	Manufacturer data	n/a	✓	✓
Length Range	100 nm – 4 µm	100 nm – 4 µm	100 nm – 4 µm	AFM	6	✓	✓
Mean Length	~0.5 micron	~1 micron	~1 micron	AFM	6	✓	✓
Catalyst Impurity	~1% by mass	~1% by mass	~0.5% by mass	NAA, TGA	3, 4	✓	✓
Carbonaceous Impurity	< 5% by mass	< 5% by mass	< 5% by mass	TGA, Raman	4, 5	✓	✓
Semiconducting CNT Content	n/a	90%, 95%, 98%, or 99+%	n/a	Optical absorbance	2	✓	✓
Metallic CNT Content	70%, 95%, 98% or 99%	n/a	n/a	Optical absorbance	2	✓	✓
Shelf Life	6 months	6 months	6 months	n/a	n/a	✓	n/a
Nanotube Concentration	0.01 mg/mL	0.01 mg/mL	0.25 mg/mL	n/a	n/a	✓	n/a
Surfactant Concentration	1% w/v	1% w/v	1% w/v	n/a	n/a	✓	n/a
Surfactant Type	Ionic (proprietary mixture)	Ionic (proprietary mixture)	Ionic (proprietary mixture)	n/a	n/a	✓	n/a

## 2016 Product Catalog

### Product Kits

**Description:** Dozens of researchers [publish groundbreaking research using our tubes](#) every year (over 500 publications as of January 2016). 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:**

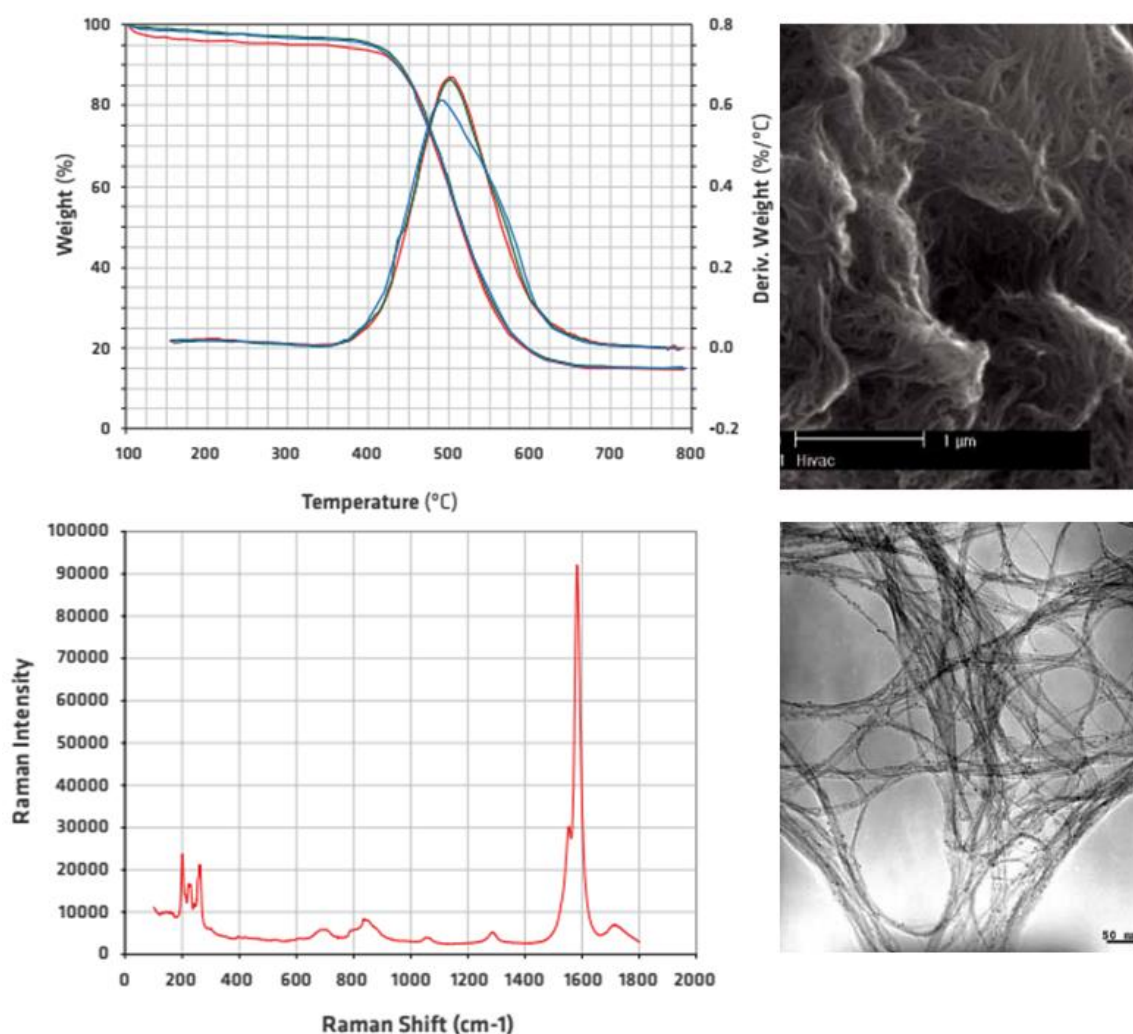
SKU#	Product	Price (USD)	Quantity (mg)
1401	Starter Aqueous	900	See above
1402	Starter Powder	950	See above
1403	Sample Aqueous	700	See above
1404	Sample Powder	750	See above
1405	Premier Aqueous	400	See above
1406	Premier Powder	450	See above



## HiPco Small Diameter SWNTs

**Description:** HiPco SWCNT represent a benchmark for small diameter nanotubes both in the academic community and for industrial and commercial applications. They are synthesized using the fluidized bed process developed by Nobel laureate Richard Smalley. 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:



NanIntegris, a Raymor Company

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# RAYMOR NanoIntegris

## 2016 Product Catalog

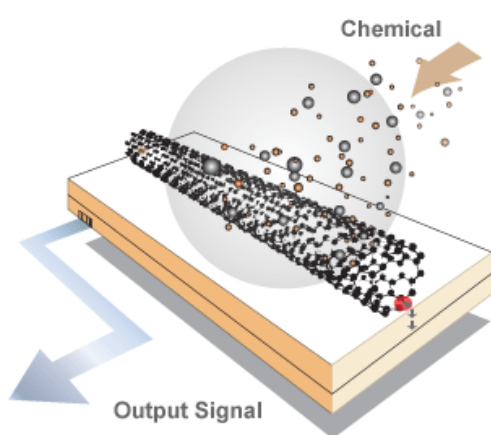
Parameter	Raw	Purified	SuperPurified
Residual Iron Content	<35%	<15%	<5%
Length	0.1-1 $\mu\text{m}$	0.1-1 $\mu\text{m}$	0.1-1 $\mu\text{m}$
Diameter	0.8-1.2 nm	0.8-1.2 nm	0.8-1.2 nm

### Prices:

SKU#	Product	Price (USD)	Quantity (g)
1601	Raw Fluffy Powder	550	1.0
1602	Raw Wet Cake	550	1.0
1603	Purified	800	1.0
1604	Super Purified	2200	1.0
1605	Metallic Enriched Aqueous	600	1.0
1606	Metallic Enriched Powder	650	1.0
1607	Semiconducting Enriched Aqueous	500	1.0
1608	Semiconducting Enriched Powder	550	1.0
1611	COOH-Functionalized	2250	1.0

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

# RAYMOR NanoIntegris

## 2016 Product Catalog

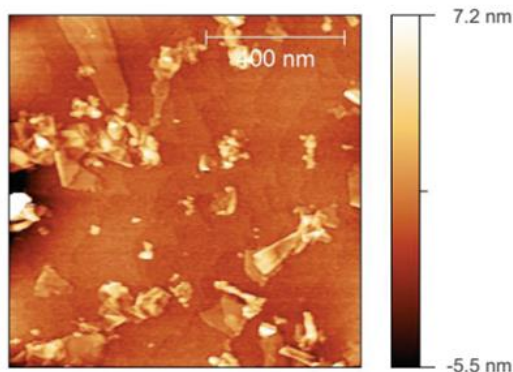
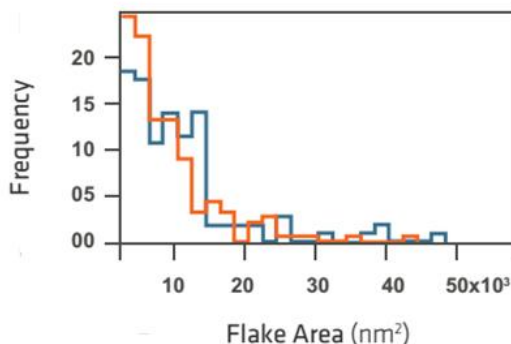
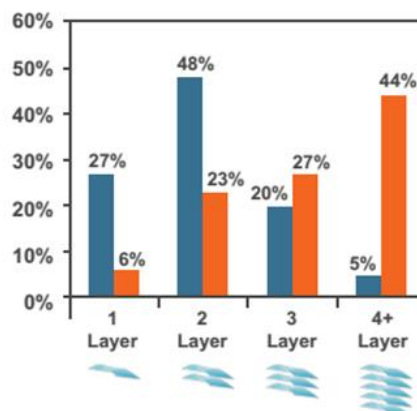
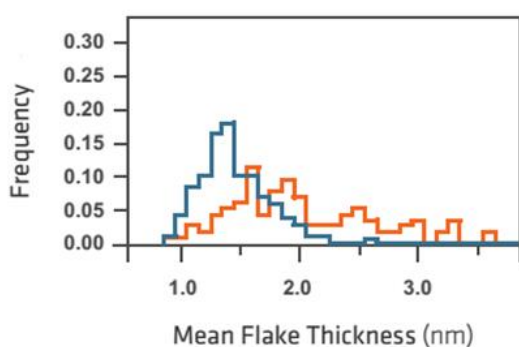
### PureSheets: 1-4 Layer Graphene Nanoplatelets

**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



NanoIntegris, a Raymor Company

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# RAYMOR NanoIntegris

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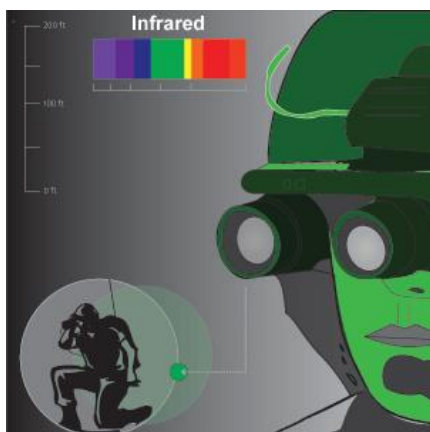
Parameter	MONO	QUATTRO	Measurement
Single Layer Content	27%	6%	AFM
Double Layer Content	48%	23%	AFM
Triple Layer Content	20%	27%	AFM
4+ Layer Content	5%	44%	AFM
Average Flake Area	10000 nm <sup>2</sup>	10000 nm <sup>2</sup>	AFM
Solution Type	Acqueous	Acqueous	n/a
Graphene Concentration	0.05 mg/ml	0.05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

### Prices:

SKU#	Product	Price (USD)	Quantity (mg)
1701	MONO Aqueous	625	400.0
1702	MONO Powder	675	400.0
1703	QUATTRO Aqueous	400	400.0
1704	QUATTRO Powder	450	400.0
1705	Graphite (non-exfoliated) Powder	80	2.0g
1706	Graphene oxide	80	2.0g
1707	Conductive Graphene Nanoplatelets	200	5.0g

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

## Did you know?



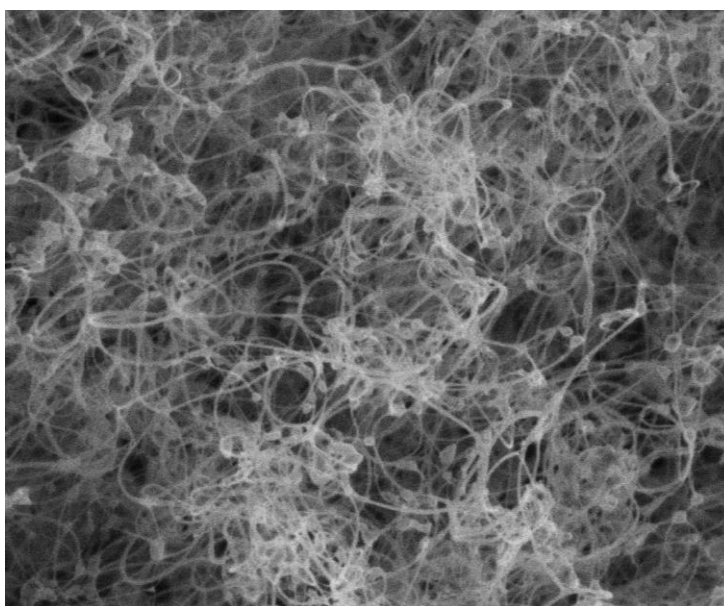
Large-diameter semiconducting SWNTs are good absorbers and emitters of light in the infrared. Moreover, high-purity SWNT thin films have been demonstrated to be photoconductive and photoluminescent under NIR illumination.

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

## Unseparated Plasma SWNTs

**Description:** Using a patented 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  $\mu\text{m}$ ) 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
I <sub>t</sub> k <sub>i</sub> s index	Optical absorption	0.06-0.08

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## 2016 Product Catalog

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 <sup>nd</sup> 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 <sup>nd</sup> oxidation peak	Thermogravimetric analysis	650 °C
Itkis index	Optical absorption	> 0.2

### Prices:

SKU#	Product	Price (USD)	Quantity (g)
1801	Super Purified (SPT-220) Aqueous	1000	1.0
1802	Super Purified (SPT-220) Powder	1100	1.0
1803	Semi-Purified (RN-220) Aqueous	155	1.0
1804	Semi-Purified (RN-220) Powder	85	1.0
1805	Air-Oxidized (RN-120) Aqueous	100	1.0
1806	Air-Oxidized (RN-120) Powder	42	1.0
1807	Raw (RN-020) Aqueous	35	1.0
1808	Raw (RN-020) Powder	20	1.0
1809	Raw (RN-000) Aqueous	35	1.0
1810	Raw (RN-000) Powder	20	1.0

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



# RAYMOR NanoIntegris

## 2016 Product Catalog

### Boron Nitride Nanotubes (BNNT)

**Description:** Boron Nitride Nanotubes (BNNT) are a brand new addition to our catalog. Their extreme resistance to high temperatures (up to 900°C in air) and optical transparency make them an ideal filler for the structural reinforcement of glass, ceramics and metal matrices. Furthermore, their high thermal conductivity may enable BNNT to solve one of the main challenges in electronic engineering: thermal management of ever smaller circuit components.

#### Specifications:



Attribute	Measurement	Method of Analysis
Purity	40 - 50% by mass	---
Number of Walls)	1 - 5 walls typical (2-3 walls most common)	---
Tube Length	$\leq 200 \mu\text{m}$	Scanning Electron Microscopy (SEM)
Surface Area	$\leq 300 \text{ m}^2/\text{g}$	Brunauer–Emmett–Teller (BET) Theory
Bundles	$\leq 5$ tubes across	Transmission Electron Microscopy (TEM)
Band Gap	5.7 eV	Low Electron energy loss spectroscopy (direct)
Residual Impurities	hBN flakes/ micro-droplets	Transmission Electron Microscopy (TEM)
Tap Density	$\sim 0.25 \text{ mg}/\text{cm}^3$	---

#### Prices:

Product	Price (USD)	Quantity (mg)
BNNT Powder	250	250.0
BNNT Aqueous Solution	300	250.0
Purified BNNT Aqueous Solution	150	3.0
Purified BNNT Powder	200	3.0
Hex-Boron Nitride Flakes	100	100g

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

# RAYMOR NanoIntegris

## 2016 Product Catalog

### 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 ( $\Omega/\square$ )	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	Silver Nanowire Ink	350	1 g / 100 ml

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

## Double and Multi-Walled Carbon Nanotubes (MWNT)

**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:**



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	1-12 $\mu$ m	10-30 $\mu$ m	10-30 $\mu$ m
Source Material	CVD	CVD	CVD
MWNTs Specific Surface Area	n/a	500 m <sup>2</sup> /g	233 m <sup>2</sup> /g
MWNTs Electrical Conductivity	n/a	>100 S/cm	>100 S/cm
MWNTs Bulk density	n/a	0.27 g/cm <sup>3</sup>	0.22 g/cm <sup>3</sup>
MWNTs True density	n/a	~2.1 g/cm <sup>3</sup>	~2.1 g/cm <sup>3</sup>

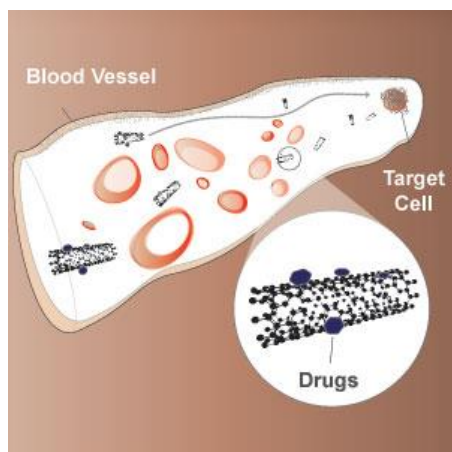
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**Prices:**

SKU#	Product	Price (USD)	Quantity (g)
2101	99%, Powder	125	5.0
2102	99%, Solution	175	1.0
2103	95%, <8nm OD Powder	65	5.0
2104	95%, <8nm OD Solution	105	1.0
2105	95%, 10-20nm OD Powder	50	5.0
2106	95%, 10-20nm OD Solution	100	1.0
2107	90% DWNT, 5-30 $\mu$ m in length	150	1.0
2108	90% DWNT, 0.5-2 $\mu$ m in length	110	1.0

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

# RAYMOR NanoIntegris

## 2016 Product Catalog

### Services

**Description:** Take advantage of our 10 years of expertise in the nanotechnology and specifically in the nanotubes industry. Raymor and NanoIntegris constitute one of the world's largest and most trusted provider of single-walled carbon nanotubes. We have produced, purified, separated, functionalized and dispersed nanotubes using the best methods in a variety of media and solvents. 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 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	50
2202	Dispersion: Aqueous	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 Fee	Ask for quote

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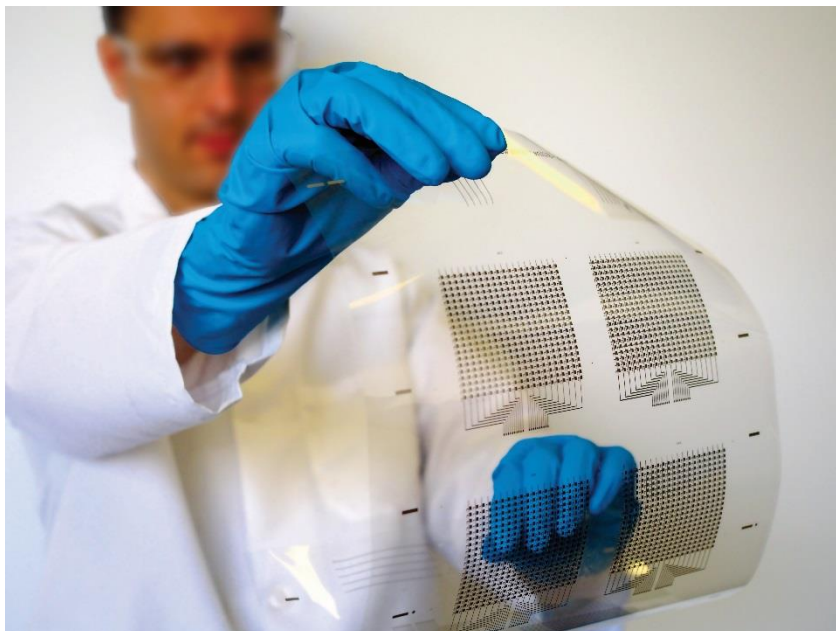
## Inks for Printed Electronics

**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 has 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:





# RAYMOR NanoIntegris

## 2016 Product Catalog

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, in 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 <sup>2</sup> /V/s	> 6 cm <sup>2</sup> /V/s
Ion / IOff ratio	1 x 10 <sup>4</sup>	1 x 10 <sup>2</sup>
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 (g)
2301	Xdi-dcs Dielectric Ink	16 \$/g	< 2000
2301	Xdi-dcs Dielectric Ink	12 \$/g	> 2000

Please view page 6 for the details of IsoSol-S100 semiconducting ink.



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through nanotechnology"**



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