NANOLAB®

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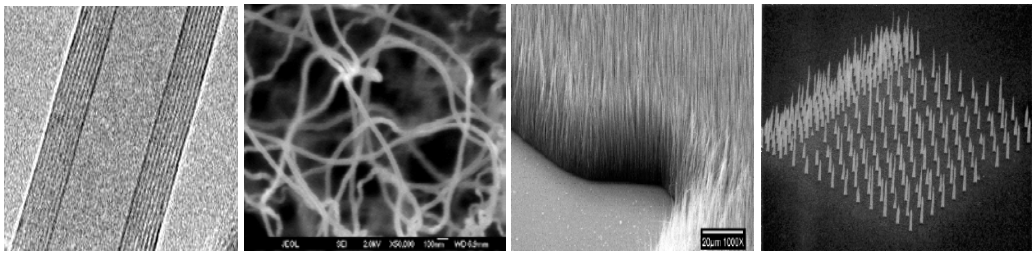
NanoLab, Inc. products are manufactured in the USA, and distributed world wide.



Catalog and Price List
2009. 1

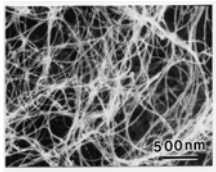
NANO LAB

Carbon Nanotubes

NanoLab offers a wide range of research grade and industrial grade carbon nanotubes. Our nanotubes are designated by their Diameter D, in nm, and Length L range in microns. Please contact us for larger quantity requests.

Single Wall Carbon Nanotubes

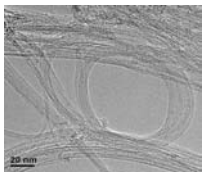
Produced by arc discharge
Average diameter:1-1.5 nm
Average length: ~10microns



Catalog No.	Purity (wt%)	Size (gram)	Price ($)
D1L1-10J	>40	1	225
D1L1-10A	>50	1	1,000
D1L1-10P	>90	1	2,500

Single Wall Carbon Nanotubes

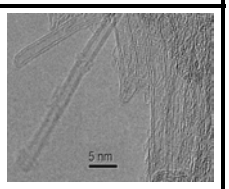
Produced by CVD methods
Average diameter: ~1.5 nm
Average length: 1-5 microns



Catalog No.	Purity (wt%)	Size (gram)	Price ($)
D1.5L1-5-S	>95	1	200
		5	900

Double Wall Carbon Nanotubes

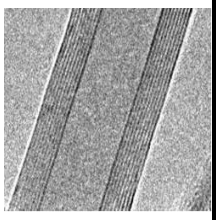
Produced by CVD method
Diameter:4 ±1 nm
Length: 1-5 microns or
5-20 microns
Purity > 95%



Catalog No.	Length (μm)	Size (gram)	Price ($)
D4L1-5	1-5	1	350
		5	1,700
D4L5-20	5-20	1	320
		5	1,550

Research Grade Multi-wall Carbon Nanotubes

Produced by CVD method
Purity: > 95%
Strict length and diameter control
SSA 200-400 m^2/g



Catalog No.	Size (gram)	Price ($)
Hollow structure MWCNT 15 nm in diameter, 1-5 microns long		
PD15L1-5	1	140
	5	650
	25	2,625
	50	4,750
	100	7,500
Hollow structure MWCNT 15 nm in diameter, 5-20 microns long		
PD15L5-20	1	110
	5	500
	25	2,250
	50	4,250
	100	6,500
Hollow structure MWCNT 30 nm in diameter, 1-5 microns long		
PD30L1-5	1	140
	5	650
	25	2,625
	50	4,750
	100	7,500
Hollow structure MWCNT 30 nm in diameter, 5-20 microns long		
PD30L5-20	1	110
	5	500
	25	2,250
	50	4,250
	100	6,500
Bamboo Structure MWNT 30 nm diameter, 1-5 microns long		
BPD30L1-5	1	150
	5	700
Bamboo Structure MWNT 30 nm in diameter, 5-20 microns long		
BPD30L5-20	1	120
	5	550

COOH Functionalized Carbon Nanotubes

Produced by CVD method, Purity: > 95%
COOH functionalized nanotubes are difficulty to disperse in certain solvents. We recommend you buy COOH functionalized nanotubes in suspensions.

Catalog No.	Size (gram)	Price ($)
COOH functionalized *hollow structure* MWCNT 15 ± 5 nm in diameter, 1-5 microns long		
PD15L1-5-COOH	1	160
	5	750
COOH functionalized *hollow structure* MWCNT 15 ± 5 nm in diameter, 5-20 microns long		
PD15L5-20-COOH	1	130
	5	600
COOH functionalized *hollow structure* MWCNT 30 ± 15 nm in diameter, 1-5 microns long		
PD30L1-5-COOH	1	160
	5	750
COOH functionalized *hollow structure* MWCNT 30 ± 15 nm in diameter, 5-20 microns long		
PD30L5-20-COOH	1	130
	5	600
COOH functionalized *bamboo structure* MWNT 30 ± 10 nm diameter, 1-5 microns long		
BPD30L1-5-COOH	1	170
	5	800
COOH functionalized *bamboo Structure* MWNT 30 ± 10 nm in diameter, 5-20 microns long		
BPD30L5-20-COOH	1	140
	5	650
COOH functionalized *double wall* nanotubes 4 ± 1 nm in diameter, 1-5 microns long		
D4L1-5-COOH	1	370
	5	1,800
COOH functionalized *double wall* nanotubes 4 ± 1 nm in diameter, 5-20 microns long		
D4L5-20-COOH	1	340
	5	1,650
COOH functionalized single wall nanotubes ~1.5 nm in diameter, 1-5 microns long		
D1.5L1-5-COOH	1	220
	5	1,000

Amide Functionalized Carbon Nanotubes

Produced by CVD method, Purity: > 95%
Amide functionalized nanotubes are difficulty to disperse in certain solvents. We recommend you buy COOH functionalized nanotubes in suspensions.

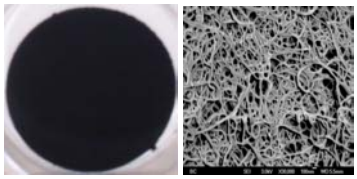
Catalog No.	Size (gram)	Price ($)
Amide functionalized *hollow structure* MWCNT 15 ± 5 nm in diameter, 1-5 microns long		
PD15L1-5-NH_2	1	160
	5	750
Amide functionalized *hollow structure* MWCNT 15 ± 5 nm in diameter, 5-20 microns long		
PD15L5-20-NH_2	1	130
	5	600
Amide functionalized *hollow structure* MWCNT 30 ± 15 nm in diameter, 1-5 microns long		
PD30L1-5-NH_2	1	160
	5	750
Amide functionalized *hollow structure* MWCNT 30 ± 15 nm in diameter, 5-20 microns long		
PD30L5-20-NH_2	1	130
	5	600
Amide functionalized *bamboo structure* MWNT 30 ± 10 nm diameter, 1-5 microns long		
BPD30L1-5-NH_2	1	170
	5	800
Amide functionalized *bamboo Structure* MWNT 30 ± 10 nm in diameter, 5-20 microns long		
BPD30L5-20-NH_2	1	140
	5	650
Amide functionalized *double wall* nanotubes 4 ± 1 nm in diameter, 1-5 microns long		
D4L1-5-NH_2	1	370
	5	1,800
Amide functionalized *double wall* nanotubes 4 ± 1 nm in diameter, 5-20 microns long		
D4L5-20-NH_2	1	340
	5	1,650
Amide functionalized single wall nanotubes ~1.5 nm in diameter, 1-5 microns long		
D1.5L1-5-NH_2	1	220
	5	1,000

Industrial Grade Multi-wall Carbon Nanotubes		
Produced by CVD method, up to 10 metric tons per year Diameter: 10-30 nm nominal Length: 5-20 microns nominal Purity: >85Wt%		
Catalog No.	**Size** (kilogram)	**Price** ($)
IG-100g	0.1	800
IG-500g	0.5	3,000
IG-1 kg	1	3,500
IG- 5 kg	5	15,000
IG-10 kg	10	25,000

Products Made from Carbon Nanotubes

1. Nanotube Paper – BuckyPaper

BuckyPapers are sheet forms of our carbon nanotubes. BuckyPapers are made from our research grade nanotubes, and can be made from other nanotube types on request. An SEM image of a typical BuckyPaper is shown at below.



Catalog No.	Shape	Size (mm)	Price ($)
CNP 40	Disc	Diameter40	200
CNP125	Disc	Diameter125	1,000
CNP175X225	rectangle	175x225	1,500

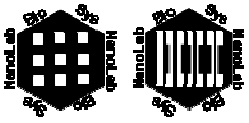
2. Nanotube Monolayer

The monolayer products are made from our research grade MWNT, PD15L1-5 or PD30L1-5. A monolayer of nanotubes is deposited on transparent substrate, such as glass or plastic, so it is compatible with fluorescent microscopy. *Other substrates are available upon request*, including silicon and many metals. Below is a price list of monolayer on 25 mm diameter glass substrates without features.

Catalog No.	Qty	Unit Price ($)
CNT-MNL-D25-Q<10	< 10	$100 per piece
CNT-MNL-D25-Q>10	> 10	$90 per piece

Features:

We can pattern the monolayers for you, using either our masks or yours. The drawings below are negatives of exemplary patterns. Features larger than 100 μm can be patterned in house, smaller features will require custom work. Please call for a quotation.



We can also immobilize various bio-molecules on these carbon nanotubes. Options include DNA, RNA, peptides, antibodies, enzymes, molecular probes, etc.

3. Nink: Printable Nanotube Ink

"**Nink**" are carbon **nanotube inks** for direct printing of nanotube electronics and sensors. This ink contains carboxyl (COOH) functionalized carbon nanotubes in an aqueous suspension with the minimum concentration of additives to impart long term stability and printability to the ink.

Multiwall-carbon-nanotube ink cartridge:
Catalog No. Nink-1000-HP45 **Price:** $200

Single-wall-carbon-nanotube ink cartridge:
Catalog No. Nink-1100-HP45 **Price:** $250

4. Nanotube Surfactant-Free Suspensions

We functionalize our research grade carbon nanotubes and suspend them in either water or dimethylformamide (DMF). These suspensions are prepared from our PD15L1-5, or PD30L1-5 products. *Different concentrations, nanotubes or solvents are available upon request.*

Catalog No.	Concentration (mg/l)	Size (ml)	Price ($)
mwcnt-diwater	40	50	100
		100	180
		200	350
bmwcnt-diwater	80	50	150
		100	280
		200	500
mwcnt-dmf	40	50	110
		100	200
		200	380
bmwcnt-dmf	80	50	160
		100	300
		200	530

Surfactant-free PECVD carbon nanotube suspensions are also available. Below tables are our standard offer.

Catalog No.	Concentration (CNTs / 10ml)	Size (ml)	Price ($)
PECVD-diwater	$1x10^9$	5	250
		10	475
		20	900
		50	2,200
PECVD-dmf	$1x10^9$	5	260
		10	495
		20	930
		50	2,300
PECVD-diwater	$4x10^9$	5	375
		10	675
		20	1,300
		50	3,100
PECVD-dmf	$4x10^9$	5	385
		10	695
		20	1,330
		50	3,200

PECVD Carbon Nanotube Parameter:

PECVD-CNT length (microns)	1	5	10	15	20
PECVE diameter (nm)	30-50	30-50	100	100-150	150-200

5. Nanotube-Toughened B_4C

NanoLab was awarded a Phase II SBIR contract by US Army to develop high toughness boron carbide composites containing carbon nanotubes. NanoLab developed hot pressing and pressure-less sintering protocols for this B_4C-CNT composite and can now manufacture various shapes using our 50 Ton hot press. Uses include armors and other common uses for B_4C. *Please contact us regarding this product.*

NanoSperse Dispersant

1. NanoSperse AQ Dispersant

This product is specially formulated for creating **aqueous** dispersions of our multi-walled carbon nanotubes. For every 0.1 gram of our multi-walled carbon nanotubes, we recommend that you use ~4 drops of the dispersant. Ultrasonication is required.

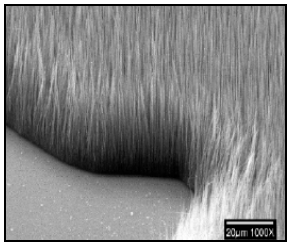
Catalog No. Nanosperse AQ
Price: $15.00 per 10ml vial

2. NanoSperse AC Dispersant

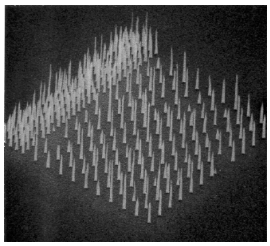
This product is a specially formulated surfactant for the creation of stable dispersions of carbon nanotubes in **non-aqueous** solvents. It may also be used to make nanotube-based inks, coatings, and screen printing formulations. It has proven effective in making dispersions in acetone, MEK, DMF, and other organic solvents.

Catalog No. Nanosperse AC
Price: $15.00 per 10ml vial

Vertically Aligned Carbon Nanotube Arrays



We offer **vertically aligned carbon nanotube arrays** on many different substrates. SEM image (left) shows the appearance of nanotubes vertically aligned on a substrate. The lists below are our standard offerings. Carbon nanotube site density: 1~2x10^9nanotubes/cm^2.



Please contact us for all other requests: unlisted substrates, complex patterning and low site densities by using micro-scale and nanoscale lithography. Image (right) is an example of patterned nanotube array.

Code Explanation:

SM - SL x SW x ST / L-L

- L-L: Range of nanotube length (microns) (1-5, 5-10,10-15, 15-20) allow +/-15% variation on length
- SL x SW x ST: Substrate length (L) (mm) x width (W) (mm) x thickness (T) (mm)
- SM: Substrate Material: below is a list of substrates.

Substrate Material Codes

Cu: Copper (#4 polished)
GC: Glassy Carbon
GF: Graphite Foil
Mo: Molybdenum (99.95% metal basis)
Pt: Platinum (99.99% metal basis)
SS: Stainless Steel (type 304, #3 finished)
Ti: Titanium (99.95% metal basis)
QZ: Quartz
Si: Silicon

Copper (#4 polished):

Size 1 Arrays:	**Size 2 Arrays:**
Price: $750 per piece	**Price**: $1,500 per piece
Catalog No.	**Catalog No.**
Cu-12.5x12.5x0.9 /1-5	Cu-25x25x0.9 /1-5
Cu-12.5x12.5x0.9 /5-10	Cu-25x25x0.9 /5-10
Cu-12.5x12.5x0.9 /10-15	Cu-25x25x0.9 /10-15
Cu-12.5x12.5x0.9 /15-20	Cu-25x25x0.9 /15-20

Glassy Carbon: Substrate Thickness (**ST**) options: 1.0 mm, 2.0 mm

Size 1 Arrays: Price: $750 per piece			**Size 2 Arrays: Price:** $1,500 per piece	
Catalog No.	**Catalog No.**		**Catalog No.**	**Catalog No.**
GC-5x5x **ST** /1-5	GC-10x10x **ST** /1-5		GC-20x20x **ST** /1-5	GC-25x25x **ST** /1-5
GC-5x5x **ST** /5-10	GC-10x10x **ST** /5-10		GC-20x20x **ST** /5-10	GC-25x25x **ST** /5-10
GC-5x5x **ST** /10-15	GC-10x10x **ST** /10-15		GC-20x20x **ST** /10-15	GC-25x25x **ST** /10-15
GC-5x5x **ST** /15-20	GC-10x10x **ST** /15-20		GC-20x20x **ST** /15-20	GC-25x25x **ST** /15-20

Graphite Foil: Substrate Thickness (**ST**) options: 0.5 mm, 1.0 mm

Size 1 Arrays: Price $750 per piece			**Size 2 Arrays: Price** $1,500 per piece	
Catalog No.	**Catalog No.**		**Catalog No.**	**Catalog No.**
GF-5x5x **ST** /1-5	GF-10x10x **ST** /1-5		GF-20x20x **ST** /1-5	GF-25x25x **ST** /1-5
GF-5x5x **ST** /5-10	GF-10x10x **ST** /5-10		GF-20x20x **ST** /5-10	GF-25x25x **ST** /5-10
GF-5x5x **ST** /10-15	GF-10x10x **ST** /10-15		GF-20x20x **ST** /10-15	GF-25x25x **ST** /10-15
GF-5x5x **ST** /15-20	GF-10x10x **ST** /15-20		GF-20x20x **ST** /15-20	GF-25x25x **ST** /15-20

Molybdenum (99.95% metal basis): Substrate Thickness (**ST**) options: 0.1 mm, 0.25 mm, 0.5 mm, 1.0 mm

Size 1 Arrays: Price $750 per piece			**Size 2 Arrays: Price** $1,500 per piece	
Catalog No.	**Catalog No.**		**Catalog No.**	**Catalog No.**
Mo-5x5x **ST** /1-5	Mo-10x10x **ST** /1-5		Mo-20x20x **ST** /1-5	Mo-25x25x **ST** /1-5
Mo-5x5x **ST** /5-10	Mo-10x10x **ST** /5-10		Mo-20x20x **ST** /5-10	Mo-25x25x **ST** /5-10
Mo-5x5x **ST** /10-15	Mo-10x10x **ST** /10-15		Mo-20x20x **ST** /10-15	Mo-25x25x **ST** /10-15
Mo-5x5x **ST** /15-20	Mo-10x10x **ST** /15-20		Mo-20x20x **ST** /15-20	Mo-25x25x **ST** /15-20

Platinum (99.99% metal basis): Substrate Thickness (**ST**) options: 0.127 mm, 0.25 mm

Size 1 Arrays: Price $750 per piece			**Size 2 Arrays: Price** $1,500 per piece	
Catalog No.	**Catalog No.**		**Catalog No.**	**Catalog No.**
Pt-5x5x **ST** /1-5	Pt-10x10x **ST** /1-5		Pt-20x20x **ST** /1-5	Pt-25x25x **ST** /1-5
Pt-5x5x **ST** /5-10	Pt-10x10x **ST** /5-10		Pt-20x20x **ST** /5-10	Pt-25x25x **ST** /5-10
Pt-5x5x **ST** /10-15	Pt-10x10x **ST** /10-15		Pt-20x20x **ST** /10-15	Pt-25x25x **ST** /10-15
Pt-5x5x **ST** /15-20	Pt-10x10x **ST** /15-20		Pt-20x20x **ST** /15-20	Pt-25x25x **ST** /15-20

Stainless Steel (type 304, #3 finished): Substrate Thickness (**ST**) options: 0.25 mm, 0.5 mm

Size 1 Arrays: Price $750 per piece			**Size 2 Arrays: Price** $1,500 per piece	
Catalog No.	**Catalog No.**		**Catalog No.**	**Catalog No.**
SS-5x5x **ST** /1-5	SS-10x10x **ST** /1-5		SS-20x20x **ST** /1-5	SS-25x25x **ST** /1-5
SS-5x5x **ST** /5-10	SS-10x10x **ST** /5-10		SS-20x20x **ST** /5-10	SS-25x25x **ST** /5-10
SS-5x5x **ST** /10-15	SS-10x10x **ST** /10-15		SS-20x20x **ST** /10-15	SS-25x25x **ST** /10-15
SS-5x5x **ST** /15-20	SS-10x10x **ST** /15-20		SS-20x20x **ST** /15-20	SS-25x25x **ST** /15-20

Titanium (99.95% metal basis): Substrate Thickness (**ST**) options: 0.74 mm, 2.0 mm

Size 1 Arrays: Price $750 per piece			**Size 2 Arrays: Price** $1,500 per piece	
Catalog No.	**Catalog No.**		**Catalog No.**	**Catalog No.**
Ti-5x5x **ST** /1-5	Ti-10x10x **ST** /1-5		Ti-20x20x **ST** /1-5	Ti -25x25x **ST** /1-5
Ti-5x5x **ST** /5-10	Ti-10x10x **ST** /5-10		Ti-20x20x **ST** /5-10	Ti -25x25x **ST** /5-10
Ti-5x5x **ST** /10-15	Ti-10x10x **ST** /10-15		Ti-20x20x **ST** /10-15	Ti -25x25x **ST** /10-15
Ti-5x5x **ST** /15-20	Ti-10x10x **ST** /15-20		Ti-20x20x **ST** /15-20	Ti -25x25x **ST** /15-20

Quartz

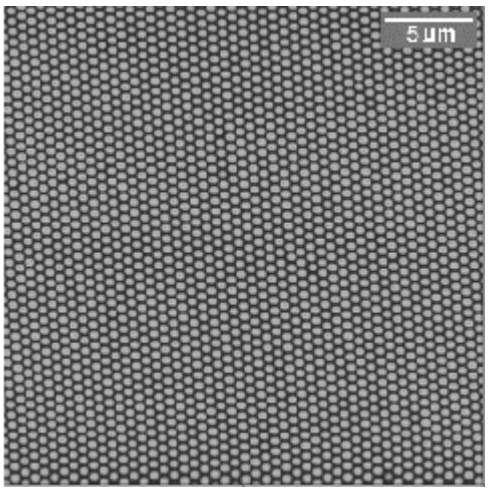
Size 1 Arrays:	**Size 2 Arrays:**
Price: $750 per piece	**Price**: $1,500 per piece
Catalog No.	**Catalog No.**
QZ-12.7x12.7x1.58 /1-5	QZ-25x25x1.58 /1-5
QZ-12.7x12.7x1.58 /5-10	QZ-25x25x1.58 / 5-10
QZ-12.7x12.7x1.58 /10-15	QZ-25x25x1.58 / 10-15
QZ-12.7x12.7x1.58 /15-20	QZ-25x25x1.58 /15-20

Silicon

Silicon is by far our most popular substrate for aligned arrays. Please tell us your requested size, thickness, orientation, etc. Alternatively you may supply your own wafer for CVD growth.

Polystyrene Sphere Arrays

Our polystyrene sphere arrays are monolayer of mono-disperse polystyrene spheres on various substrates. These highly perfect crystals are useful as sputtering masks, and have optical properties similar to that of opal. We have successfully deposited polystyrene sphere arrays on 3" silicon wafers.
Below is a partial list of substrate materials and polystyrene sphere sizes.



Please add a sphere size to the item number.

Catalog No.	Substrate Material	Sphere Size D (microns)	Price ($)
Substrate Size; 5mm x5 mm			
PSA-GL-5x5D	Glass	0.5, 1.0, 2.0	100
PSA-GR-5x5D	Graphite	0.5, 1.0, 2.0	100
PSA-Si-5x5D	Silicon	0.5, 1.0, 2.0	100
PSA-SS-5x5D	Stainless Steel	0.5, 1.0, 2.0	100
Substrate Size: 10mm x 10mm			
PSA-GL-10x10D	Glass	0.5, 1.0, 2.0	200
PSA-GR-10x10D	Graphite	0.5, 1.0, 2.0	200
PSA-Si-10x10D	Silicon	0.5, 1.0, 2.0	200
PSA-SS-10x10D	Stainless Steel	0.5, 1.0, 2.0	200

Nanoparticles

1. Cobalt Nanoparticles

Highly Monodisperse Cobalt Colloids in Hexane or Toluene have a concentration of 0.01 Molar. Available Cobalt particle sizes include: 8nm, 10nm, or 12nm (Actual size may vary depending on supplies) Sold in 5 ml vial,
Price: $1000 per vial

Catalog No.	Solvent	Co Size
Co8H	Hexane	8 nm
Co8T	Toluene	8 nm
Co10H	Hexane	10 nm
Co10T	Toluene	10 nm
Co12H	Hexane	12 nm
Co12T	Toluene	12 nm

2. Nickel Nanoparticles

Our **nickel** nanoparticles are a 99+% nickel nanopowder with a size range between 50 and 120nm. This material has a specific surface area of ~5 m^2/g, and is shipped as a dry powder. The Nickel powder can also be formulated as a paste, ink or suspension

Catalog No.	Unit Price	Price /package ($)
Ni -5g	$4.0/g	20
Ni -50g	$2.0/g	100
Ni -250g	$1.2/g	300
Ni -500g	$1.1/g	550
Ni -1000g	$0.95/g	950

Special Capabilities

NanoLab maintains facilities for the prototyping and production of various nanomaterials, nanocomposites, and nanoscale devices. We team with companies and universities to develop technologies and bring new products to market. Contact David Carnahan, dcarnahan@nano-lab.com for partnering information.