

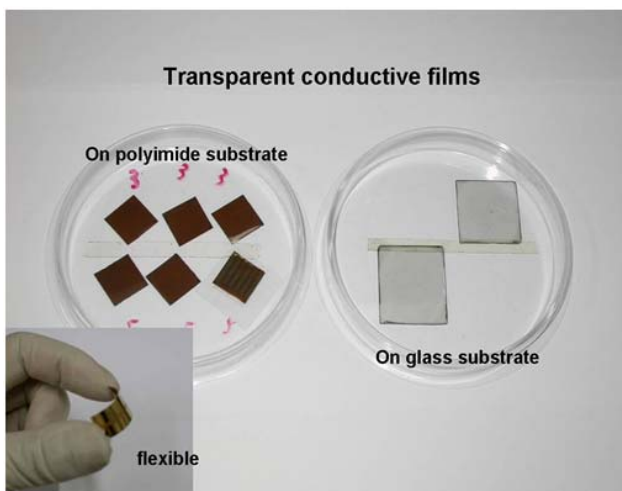
Graphene Products

1. Graphene Coatings
2. Single & Few Layer Graphene Oxide
3. Graphene Nanoplatelets
4. Graphene Inks
5. Graphene Scrolls
6. CVD Graphene film
7. 3D Graphene Foams

Single Layer Graphene Coating

Reduced Single Layer Graphene coatings are now available with the specifications below.

	1. Single Layer Graphene film on glass/wafer	2. Single Layer Flexible Graphene film on organic flexible substrate
thickness	5-30 nm	5-30 nm
area	~ 3-5 cm ² other sizes available	~ 3-5 cm ² other sizes available
conductivity	$10^4 - 10^5 \text{ Sm}^{-1}$	$10^3 - 10^4 \text{ Sm}^{-1}$
sheet resistance	$10^1 - 10^3 \Omega/\text{sq}$	$10^2 - 10^4 \Omega/\text{sq}$



Above- Graphene Oxide and Reduced Graphene Oxide Coatings on Glass, SI, or Polyimide Substrates

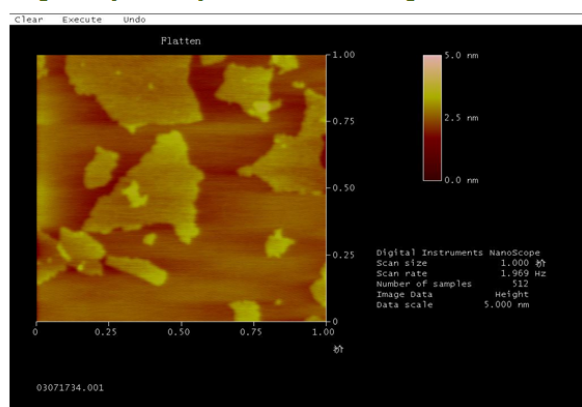
Single-Layer Graphene Oxide

Single-Layer Graphene Oxide Materials

Lateral Dimensions:	~300 x 800nm
Purity	>99wt%
Surface area	200-400m ² /g
Thickness:	0.7-1.2 nm by AFM
Solubility solvent	DI Water, NMP, DCB & DMF

Single Layer Graphene Dispersions in 2mg/ml - 10mg/ml concentrations or higher

Single Layer Graphene Oxide Images



Few Layered Graphene Oxide

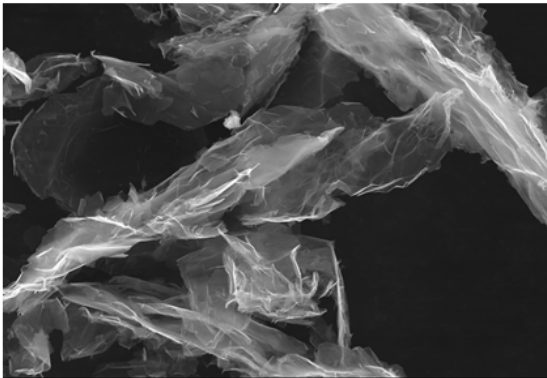
FLGO 2-4 Layers, 4-8 Layers	
purity	> 99wt%
thickness	<3nm
Surface area	300-500m ² /g
Average X & Y dimensions of individual flakes range	300-800nm.
surfactant free dispersions	DI water, DMF, or NMP solvents
stable for 1 year	

氧化石墨烯分散液 SLGO dispersed

In DI water Concentration: 5mg/mL 包裝: 1000 ml、175ml、 60ml	Composition: Carbon (79%), Oxygen (20%) Flake size: 0.5-0.7 microns
in Ethanol Dispersion Concentration: 5mg/mL 包裝: 100 ml	Thickness: 1 atomic layer - at least 60% Color:Brown

Graphene Nanoplatelets (GNPs) Grades 3 and Grades 4

Grade 3 (Industrial Grade)	
layers:	4-5
thickness:	8nm
typical particle diameters:	<2 micron
applications:	requiring high capacitance
Grade 4 (Research Grade)	
layers:	<3
thickness:	<3nm
available sizes:	5, 15,25 micron diameters
applications:	highly crystalline
measured using experimental NMR	



官能基化石墨烯 functionalized GNPs grade 4

OH, COOH, N2, F or primarily NH2 groups. Other functionalities are available	
Functionalized contain	(7±1.5)%
Source Material	Natural Graphite
Process	Split Plasma
Form Supplied	Dry Powder
Packaging	Nano-suitable airtight container

Single Layer Graphene Oxide Applications

Solar Energy

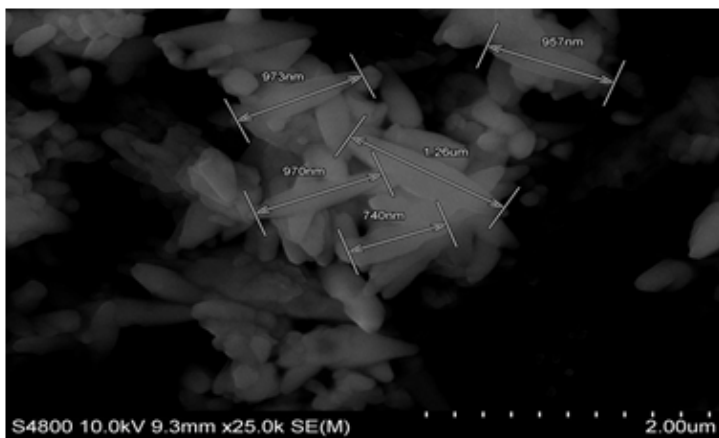


石墨烯目錄

Graphene Semiconductor Chips
Conductive Graphene Films
Graphene Communications Chips
Graphene Computer Memory
Graphene Sheets
Transparent Conductive Coatings
Many others yet to be discovered

Graphene Scrolls

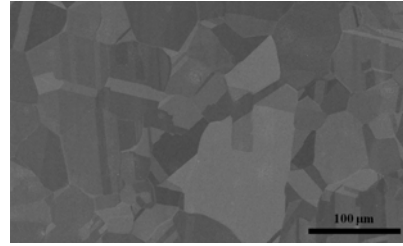
Length:	<1 um
Diameter:	10-200 nm
Layer:	1-3
Ended:	Open
Application: Drug delivery , superconductivity and electro mechanical actuator	



An SEM image of grapheme scrolls

另有提供 **石墨烯導電油墨及透明導電油墨** ， 如有需要請聯絡我們！

石墨烯薄膜 (CVD Graphene film)



我們主要提供的是由化學氣相沉積 (CVD) 加工製成的石墨烯薄膜，這些石墨烯薄膜在銅箔及鎳箔的表面成長，將底層銅箔蝕刻後可轉移至其他基板，如玻璃、二氧化矽或塑料薄膜等。亦有提供已成功轉移至基板上之成品，歡迎來電洽詢。

Product	Picture	產品編號	Size	Substrate	Weight
Single Layer Graphene on Copper Foil		t-CVD-Cu-22	2"x2"	Cu	0.10 lbs
		t-CVD-Cu-24	2"x4"	Cu	0.10 lbs
		t-CVD-Cu-44	4"x4"	Cu	0.10 lbs
Multilayer Graphene on Nickel Foil		t-CVD-Ni-22	2"x2"	Ni	0.10 lbs

應用範圍：

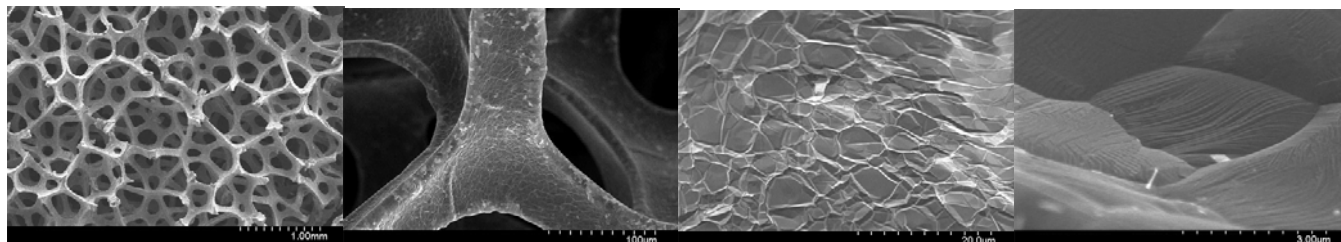
- 石墨烯電子產品
- 導電塗料
- 航空航太工業
- 輔助金屬催化劑
- 微促動器 (Microactuators)
- 微電子機器系統 MEMS 和奈米機電系統 NEMS
- 化學和生物傳感器
- 基於石墨烯的多功能材料
- 石墨烯的相關研究

參考文獻：

1. "Continuous, Highly Flexible, and Transparent Graphene Films by Chemical Vapor Deposition for Organic Photovoltaics." Lewis Gomez De Arco et al. ACS Nano, Volume 4, Issue 5 (2010), pp. 2865-2873
2. "A direct transfer of layer-area graphene." William Regan et al. Appl. Phys. Lett., Volume 96 (2010)
3. Large-Area Synthesis of High-Quality and Uniform Graphene Films on Copper Foils
Science 5 June 2009: Vol. 324. no. 5932, pp. 1312 - 1314
4. Roll-to-roll production of 30-inch graphene films for transparent electrodes
Nature Nanotechnology 5, 574-578 (2010)

三維石墨烯泡沫 (3D Graphene Foams)

經由化學氣相沉積 (CVD) 加工製成的三維石墨烯泡沫，具有非常高的表面積，同時保有二維石墨烯之特性，其超輕薄、高導電性、卓越的機械強度，柔韌性與彈性開啟了許多應用領域。



Picture	Product	Size	Substrate	Thickness (mm)	Pore Size (microns)	Density (mg/cm ²)
	3D-Cu-G-Foam-1.5x1.5	1.5"x1.5"	Cu	1.2	580	320
	3D-Cu-G-Foam-2x4	2"x4"	Cu	1.2	580	320
	3D-Ni-G-Foam-2x2	2"x2"	Ni	1.2	580	320
	3D-Ni-G-Foam-2x4	2"x4"	Ni	1.2	580	320
	3D-FREE-G-Foam-2x2	2"x2"	no metal support	1.2	580	4mg/cm³

石墨烯泡沫的可能應用之一為化學傳感器。使用石墨烯泡沫作出的石墨烯傳感器其敏感度約超過目前市面上的傳感器 10 倍以上。可檢測到濃度僅 20ppm 的二氧化氮。除此之外還能夠在室溫下偵測氣體，而現今許多市面上的傳感器則需要高溫下才能夠正常運作。石墨烯泡沫的多孔性質不僅使它比市售傳感器更加有效率且可重複使用。

石墨烯泡沫由於其天然多孔性具有高表面積，因此可以被運用於儲能方面，如超級電容器與電池。其結構具有存儲大量能源的潛力(例如氫)，使它成為電化學高電容。

參考文獻：

- "Three Dimensional Flexible and Conductive Interconnected Graphene Networks Grown by Chemical Vapour Deposition." Chen, Z. et al. Nature Mater., 10 (2011), pp. 424-428.
- "High Sensitivity Gas Detection Using a Macroscopic Three-Dimensional Graphene Foam Network." Yavari, F. et al. Scientific Reports, article 166 (2011).
- "Gram-scale synthesis of nanomesh graphene with high surface area and its application in supercapacitor electrodes." Ning, G. et al. Chem. Commun., 47 (2011), pp. 5976-5978.
- "Three-Dimensional Self-Assembly of Graphene Oxide Platelets into Mechanically Flexible Macroporous Carbon Films." Lee, S. et al. Angew. Chem. Int. Ed., 49 (2010).