

GO CORE PRODUCTS

Graphene Oxide Pastes

- GOX8™ Graphene Oxide AH920
- GOX8™ Graphene Oxide AA925
- GOX8™ Graphene Oxide AL910
- GOX8™ Graphene Oxide AB905

Graphene Oxide Powder

- GOX8™ Graphene Oxide P935
- GOX8™ Graphene Oxide P950
- GOX8™ Graphene Oxide P9100

LayerOne Graphene Oxide (GO) is produced using a proprietary modified Hummer's method. GO is available as powder and as paste.

GO powder products are available at three different mesh sizes (<35, 50-100, and <100 mesh).

GO paste products are supplied at different solid concentrations (5, 10, 20 and 25 wt.%) in water, and with different residual acidity. All GO paste products are made starting from the same standard grade of Graphene Oxide, and the difference in solid concentration arises from different preparation methodologies.

Custom GO pastes and powder can be prepared on demand with different GO oxidation degree, paste solvents and/or solid concentrations.

COMPOSITION & PROPERTIES

GO pastes properties		GOX8™ Graphene Oxide AH920	GOX8™ Graphene Oxide AA925	GOX8™ Graphene Oxide AL910	GOX8™ Graphene Oxide AB905
Color		Dark brown			Black
Odor		Odorless			Faint odor of NH3
Bulk density		m ~1.2 g/cm3	~1.25 g/cm3	~1.1 g/cm3	~1.05 g/cm3
Solid content		20 – 21 wt. %	25-26 wt. %	10 wt. %	5 wt. %
Water content		79 – 80 wt. %	74-75 wt. %	90 wt. %	95 wt. %
HCl content (ICP)		1 – 1.5 wt. %	< 1 % wt. %	<< 1 wt. %	<< 1 wt. %
pH (when diluted to 0.1 wt. %)		2.5	3	4	-
Acid site density (titration)		~1.3 mmol/g	~1.3 mmol/g	~ 0.4 mmol/g	-
Number of layers*	(Raman)	3-5			-
	(AFM)	1			-
Zeta potential		About -50 mV	-40 mV	-54 mV	NA
C/O atomic ratio (XPS)		2.5 – 2.6	2.4 – 2.6	3.1 – 3.2	2.8
Dispersibility		Polar solvent (water)			

*AFM are prepared from suspension diluted to < 1 ppm treated in ultrasound bath whereas Raman is performed on very concentrated suspensions. At high concentrations there is not room for complete delamination.

GO dry powder properties		GOX8™ Graphene Oxide P935	GOX8™ Graphene Oxide P950	GOX8™ Graphene Oxide P9100
Primary sheet aspect ratio		90% 300-3000 nm	90% 300-3000 nm	90% 300-3000 nm
Crystalline Phase		> 99% GO	> 99% GO	> 99% GO
Crystallinity (TEM)		~60 % area oxidized	~60 % area oxidized	~60 % area oxidized
Mesh size		< 35 mesh	50-100 mesh	< 100 mesh
Chemical Composition** (XPS, wt%)	Carbon	64 – 65 wt. %	64 – 65 wt. %	64 – 65 wt. %
	Oxygen	33 – 34 wt. %	33 – 34 wt. %	33 – 34 wt. %
	Sulfur	1 - 2 wt. %	1 - 2 wt. %	1 - 2 wt. %
	Nitrogen	< 1 wt. %	< 1 wt. %	< 1 wt. %
	Chloride	~ 1 wt. %	~ 1 wt. %	~ 1 wt. %
	Metals	Not Detected	Not Detected	Not Detected

Chemical analysis refers to wt. % on water free basis

OTHER INFORMATION

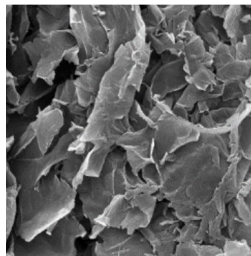
CAS No: 1034343-98-0
EC/list no: 942-699-3

Made in Norway by LayerOne AS
More info: www.layeronematerials.com

APPLICATIONS

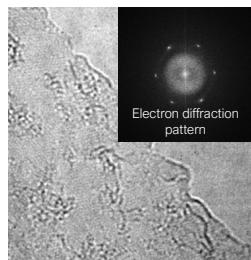
- Water purification
- Membranes
- Coatings
- Composites
- Packaging
- Lubricant oils
- R&D
- Biomaterials
- Energy materials

SEM AND TEM MICROSCOPIES



SEM

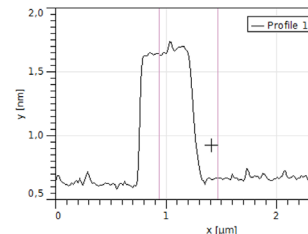
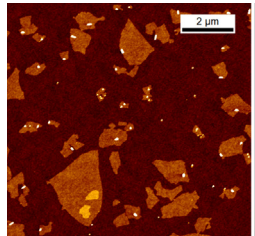
GO dried flakes (freeze dried paste) with size of 2- 20 micron. Each flake contains numerous primary single sheets.



TEM

Shows oxidized regions and non-oxidized regions. GO single sheet electron diffraction pattern insert.

AFM MICROSCOPY

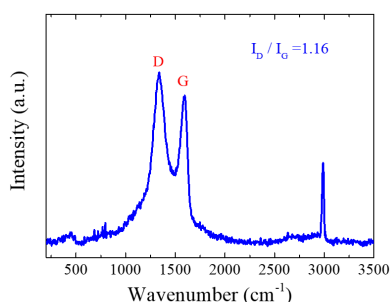


Dried GO dispersion on mica substrate

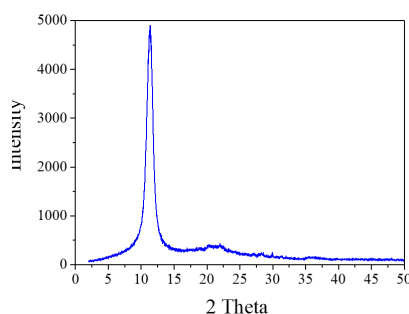
Brown features are single sheets, yellow large features are single sheets lying on top of first single sheets. Small white spots are dry salt from dried aqueous solution.

The height profile of the observed GO flakes correlates well to a single sheet having about 1 nm thickness.

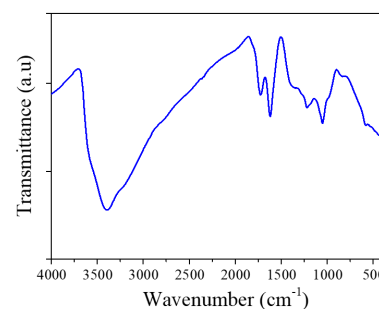
SPECTROSCOPIES



Raman spectra of concentrated GO paste shows an I_D/I_G of 1.16, which is very close to the ratio usually reported for GO.



XRD on GO powder. The peak at 11.42° corresponds to the (001) diffraction peak of GO. Spacing between GO sheets is calculated around 0.8 nm.



FTIR of GO powder dispersed in KBr pellets shows epoxy, hydroxy, carbonyl, and carboxy functional groups.

SAFETY & STORAGE

Read MSDS carefully before handling of product.

- The product is only for laboratory use by certified personnel.
- Use laboratory gloves.
- If dry powder, use dust-mask.
- Do not heat rapidly to above 60°C as this can cause an explosive exothermal reaction.
- Store in a closed container dark and cool, preferably at $+4^\circ\text{C}$.

DISPERSION IN WATER

- Stir the powder or dilute the paste into distilled or de-ionized water, until no visible particles are present, then use a sonication bath for about 0.5 h.
- To obtain single sheets, the concentration should be below 0.04 wt. %.
- If dried, the product cannot be re-dispersed.

For more information about product handling contact LayerOne: hello@layeronematerials.com