

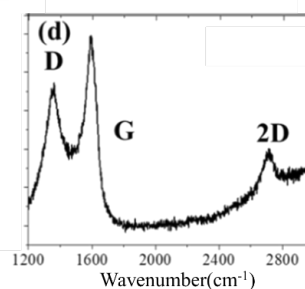
## N doped Graphene platelet

### Material Safety Data Sheet (MSDS)

#### 1. Identification of the substances/mixture and of Product information

<b>Product Name</b>	Nitrogen doped Graphene
<b>Synonyms</b>	Graphene, graphene sheets, graphene flakes, graphene powder, few layers graphene, graphite powder
<b>Use of Substance</b>	As an additive in coatings, composites, polymers Biotechnology related applications are restricted to research purpose only
<b>Supplier/Manufacturer</b>	LIG Nanowise Ltd
<b>Postal Address</b>	Unit 15 Williams House, Manchester Science Park, Pencroft Way, Manchester M15 6SE

<b>Form:</b>	Powder (flakes) stored in NMP or DMSO or DMAc
<b>Number of layers:</b>	5-10
<b>Structure:</b>	Honeycomb ( pore size mainly 10 nm-2 μm )
<b>Flake size:</b>	mainly 5-20 μm
<b>Colour:</b>	Dark-grey
<b>Carbon content:</b>	>90%
<b>Sheet Resistance:</b>	<100 Ohm/sq
<b>Hydrophobicity:</b>	Water contact angle <65°, hydrophilic, easy to mix with other liquids.



Typical Raman Spectrum

#### 2. Hazard identification

<b>Emergency Overview</b>	<ul style="list-style-type: none"> <li>• May form combustible dust-air mixture</li> <li>• May cause eye irritation</li> <li>• May cause respiratory tract irritation</li> </ul>
<b>Main Hazards</b>	<ul style="list-style-type: none"> <li>• Ultrafine carbon powder and dust is electrically conductive</li> </ul>

	<p>and may result in accumulation of electrostatic charges. These charges may cause damages to electrical and electronic components.</p> <ul style="list-style-type: none"> <li>• Ultrafine carbon powder and dust can cause irritation to eyes and respiratory system.</li> </ul>
<b>Potential Health Hazards</b>	<ul style="list-style-type: none"> <li>• Inhalation and skin contact are expected to be the primary routes of occupational exposure to this material.</li> <li>• Prolonged or repeated contact may remove oils from the skin and may dry skin and cause irritation, redness, and rash.</li> <li>• Direct contact of dust with skin and eyes may cause irritation.</li> <li>• Over exposure to dust may cause respiratory tract irritation.</li> </ul>
<b>Physical Hazards</b>	<ul style="list-style-type: none"> <li>• Medical conditions aggravated by exposure: asthma, allergies</li> <li>• Potential environmental effects: May cause adverse long-term effects.</li> </ul>

### 3. First aid measures

<b>Eye Contact</b>	Rinse immediately with plenty of water, also under eyelids, for at least 15 min. Obtain medical attention
<b>Skin Contact</b>	Wash immediately the exposed area with soap and water, rinsing thoroughly and remove contaminated clothing. Seek medical attention if irritation persists.
<b>Ingestion</b>	Do not induce vomiting. Obtain medical attention
<b>Inhalation</b>	Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.
<b>Protection of first aiders</b>	Ensure that medical personnel are aware of the material(s) Involved, take precautions to protect themselves and prevent spread of contamination.

### 4. Firefighting measures

<b>Fire and Explosive Properties</b>	Auto-Ignition Temperature
<b>Properties</b>	Melting point 3652°C Flash Point n/a Flammable Limits Upper/Lower n/a
<b>Fire Hazards</b>	Burning produces irritation. May combust to toxic fumes with CO content in

	oxygen deficient conditions.
<b>After Inhalation</b>	Move the exposed person to fresh air. If required provide artificial respiration with oxygen and seek medical attention.
<b>Extinguishing Media</b>	Use water spray or dry powder or carbon dioxide. Do not allow water runoff to enter sewers or drains.
<b>Fire Fighting Instructions</b>	<p>Do NOT use a solid stream of water. A solid stream of water can cause a dust explosion. Fire fighters and others who may be exposed to products of combustion should wear full firefighting turn out gear and self-contained breathing apparatus. Firefighting equipment should be thoroughly decontaminated after use.</p> <ul style="list-style-type: none"> <li>• Suitable extinguishing media: water, carbon dioxide, dry chemical powder or foam as appropriate for surroundings.</li> <li>• Special hazards caused by the material, its products of combustion or resulting gases: In the event of a fire, the following may be released: Carbon dioxide, Carbon monoxide or other toxic gases.</li> <li>• Protective equipment: Wear self-contained breathing apparatus for firefighting if necessary.</li> <li>• In general, graphite is difficult to combust. Standard care should be taken to avoid dust explosion risk through high concentrations of dust or finely suspended airborne particle. However, graphite dust is not normally considered an explosion hazard.</li> </ul>

## 5. Accidental Release Measures

<b>Person Related Safety Precautions</b>	Wear suitable protective equipment. Wear suitable respiratory equipment according to Health and Safety Executive guidelines for use of nanomaterials at work. Ensure appropriate ventilation in the working area and avoid raising dust. If the operator gets in contact with the materials, it is recommended to seek a full body shower as soon as possible where skin and hair can be washed with water and soap.
<b>Environmental Precautions</b>	The product should not enter drains. Advise local authorities if large spills cannot be contained.
<b>Methods for Cleaning and Collecting</b>	Clean small spillage with water and detergent or a wet cloth. For larger spillages, use ATEX rated vacuum cleaner equipped with HEPA

	filter. Clean spillage area with water and detergent. Wastes and contaminated items should be double bagged, sealed and disposed as hazardous waste.
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## 6. Physical and Chemical Properties

<b>Appearance</b>	Grey or black agglomerated powder
<b>Odour</b>	Odourless. Could sometimes present a burned-like smell.
<b>Melting Point</b>	Approximately 3,600 °C
<b>Flash Point</b>	No data applicable
<b>Boiling Point</b>	No data applicable
<b>Vapour Density</b>	No data applicable
<b>Bulk Density</b>	Not determined
<b>Solubility in Water</b>	Not soluble
<b>Evaporation Rate</b>	No data applicable
<b>Ignition Temperature</b>	Dispersed dust cloud: >600°C, deposited dust: >365°C
<b>Decomposition Temperature</b>	No data applicable
<b>Danger of explosion</b>	No data applicable
<b>Vapour pressure</b>	No data applicable
<b>Vapour density</b>	No data applicable
<b>Bulk density</b>	No data applicable
<b>Water solubility</b>	No data applicable
<b>Explosive properties</b>	No data applicable
<b>Oxidising properties</b>	No data applicable

## 7. Stability and Reactivity

<b>Stability</b>	This material is considered stable under normal and anticipated storage and handling conditions.
<b>Materials to Avoid</b>	Avoid contact with strong oxidizing agents, halogens, alkali metals and acids.
<b>Conditions to Avoid</b>	Heat and open flames
<b>Hazardous decomposition products</b>	There is not known hazardous decomposition products.

## 8. Toxicologic

<b>Toxicological Information</b>	The product contains engineered platelets which have structural features with at least one dimension of 2 micrometers or more.
<b>Acute Toxicity</b>	Primary irritant effect on skin – Irritation to skin and mucous membranes Primary irritant effect on eye – irritating effect Sensitisation – No effects known Chronic toxicity – Inhalation of graphite (natural and synthetic) have shown to cause pneumoconiosis. Similar to coal worker's pneumoconiosis.

## 9. Handling and storage

<b>Handling</b>	Avoid creating dust during handling, transfer or clean up and prevent dust accumulation e. g. by wetting and careful handling. Avoid agitation when dry or in an uncovered liquid. Avoid ultrasonication treatment in an open container. Avoid contact with eyes, skin and reduce aeration of dust wherever inhalation of dust is possible. Handling in nanoparticle should be performed in a nanoparticle filter cabinet.
<b>Storage</b>	Keep away from oxidizing agents, ignition sources and heat. Avoid contact with acids. Keep in a cool, dry, and well-ventilated area. Keep containers tightly closed and store in correctly labelled containers.

## 10. Ecological Information

<b>Toxicity</b>	No data available
<b>Persistence and degradability</b>	No data available
<b>Bioaccumulative potential</b>	No data available
<b>Mobility in soil</b>	No data available
<b>Other adverse effects</b>	No data available
<b>General notes</b>	Do not release without adequate government authorization

## 11. Exposure controls

<b>Exposure Guidelines</b>	Not yet established. Keep exposure as low as it is technically feasible. For information, levels for graphite are: Graphite (CAS no. 7782-42-5) TWA:
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	ACGIH (TLV): 2.0 mg/m <sup>3</sup> respirable OSHA (PEL): 15 mL/m <sup>3</sup> respirable
<b>Storage</b>	Keep away from oxidizing agents, ignition sources and heat. Avoid contact with acids. Keep in a cool, dry and well-ventilated area. Keep containers tightly closed and store in correctly labelled containers.
<b>Engineering Measures</b>	Local Exhaust Ventilation should be used, ducted fume cabinets or nanoparticle filter cabinets with a H14 HEPA filter is recommended. If this is not practical respiratory protection must be worn.
<b>Respiratory Protection</b>	Suitable full-face protection with P3 (EN143) / N100 filter or other respiratory protection that meets applicable OSHA requirements should be maintained in the workplace.
<b>Hand Protection</b>	Single use nitrile or vinyl gloves should be worn.
<b>Eye Protection</b>	Approved safety goggles / safety glasses under appropriate government standards such as NIOSH (US) or EN 166(EU).
<b>Skin Protection</b>	Wear disposable protective clothing and gloves that does not retain dust. Glove Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min

## 12. Waste disposal

<b>General Information</b>	Do not allow product to enter drains. Do not flush into surface water.
<b>Disposal Methods</b>	Dispose of this product and all contaminated materials in compliance with all local and national regulations. In the European Union, waste carbon nanotubes material should be classified and coded as hazardous waste. Based on current information, high temperature incineration in a hazardous waste incinerator is the preferred disposal method. Heating above 550°C will oxidize NGP completely.

## 13. Transport Information

<b>Transport Information</b>	This product is not classified as dangerous to transport regulations. Transport in an airtight container, package in at least two layers, i.e. double bagged. Protect contents from spilling and packaging damage which might result in material escape using a suitable carriage system. Clearly label packaging and keep an MSDS on the outside off all packaging.
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