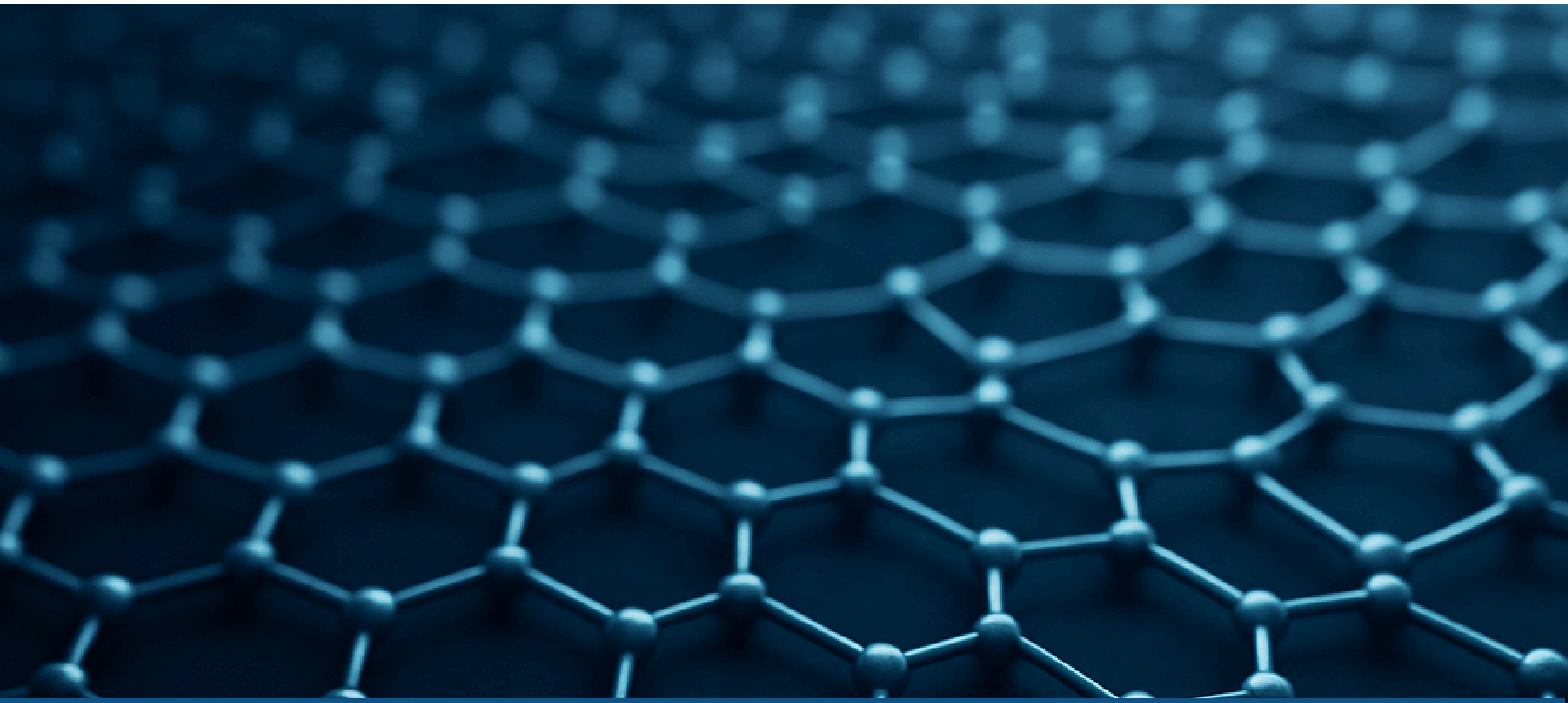
MATrexia
ADVANCED TECHNOLOGIES

CATALOGUE



MATREXIA ADVANCED TECHNOGIES PVT. LTD.

Materialising Innovations with R&D Services and Manufacturing

www.matrexia.com

OUR TEAM

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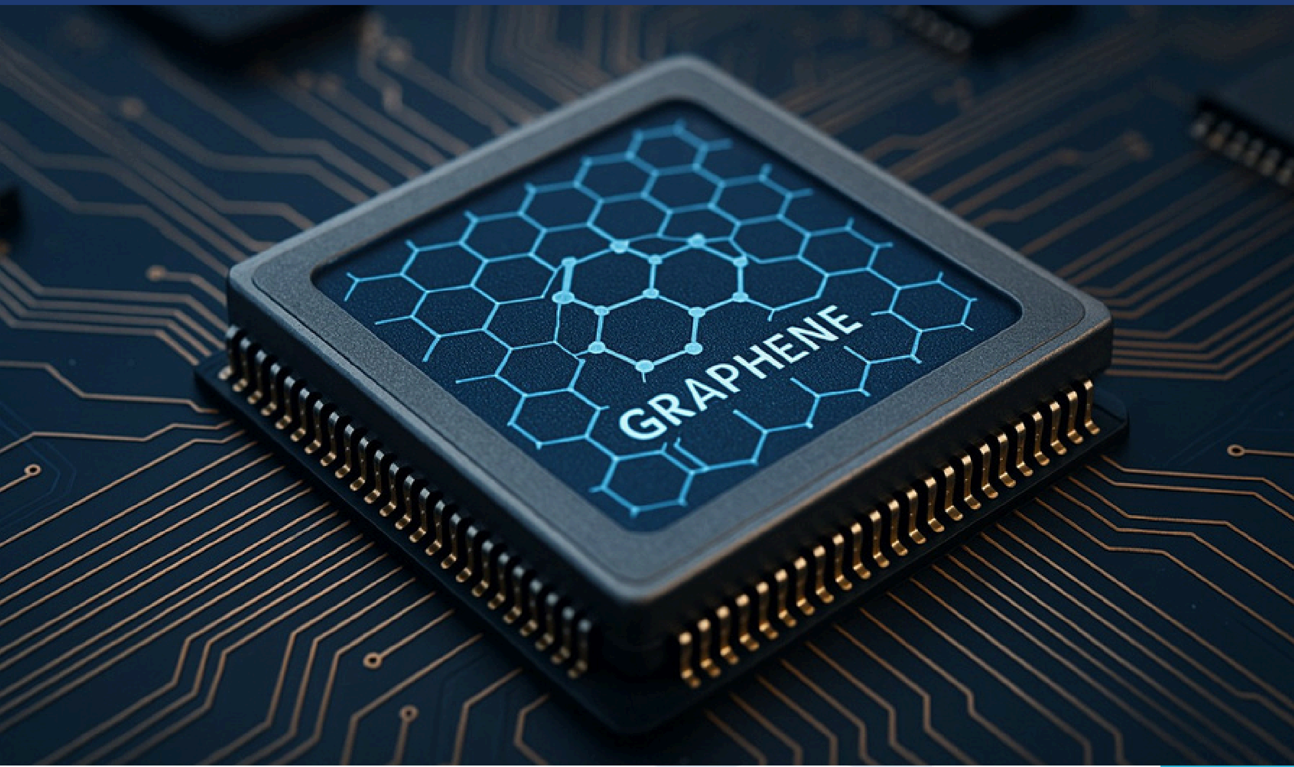


WHO ARE WE?

Founded in 2025 and based in Dankuni, West Bengal, Matrexia aims to integrate graphene and advanced materials into everyday life. We develop next-generation, high-purity few-layer graphene (FLG) and graphene-enhanced composites that power innovation across electronics, aerospace, energy storage, coatings, and healthcare.

Backed by cutting-edge R&D and a skilled team of scientists and engineers, our facility delivers precision, scalability, and performance at global standards. At Matrexia, we don't just manufacture materials—we enable transformative solutions.

By bridging research with real-world applications, we make graphene accessible, sustainable, and practical, driving a future defined by smart, high-performance technologies.

HOW DO WE OPERATE?

At Matrexia Advanced Technologies, we are driven by a commitment to excellence and innovation in every step of our process.
Our operational approach ensures seamless integration of quality, sustainability, and customer-centric solutions.

QUALITY CHECK

We start with high-purity, premium-grade graphite to ensure top-quality graphene. Superior raw material means higher monolayer or few-layer graphene yields, essential for advanced applications, while reducing purification needs and environmental impact.

SUSTAINABLE MANUFACTURING

Our production process is designed to be energy-efficient, low-emission, and waste-conscious, ensuring graphene is produced with a minimal environmental footprint and maximum efficiency

CUSTOMIZED PRODUCTS

We offer graphene powders tailored to specific industrial needs, with controlled flake sizes, thickness, and properties such as purity, conductivity, and surface functionality. Applications include composites, batteries, coatings, and more.

COST EFFECTIVENESS

Through strategic sourcing and continuous R&D, we've developed a scalable, cost-efficient production model that makes high-quality graphene accessible across industries.

HOW DO WE OPERATE?

Matrexia Advanced Technologies is at the forefront of research and development, fostering strong collaborations to drive innovation.
We complement our R&D efforts with a robust distribution network, ensuring timely and reliable delivery of advanced solutions.

R&D AND COLLABORATIONS

We invest heavily in R&D and active collaborations with leading academic institutions and industry partners. These partnerships help us stay at the forefront of graphene innovation and expand real-world applications globally.

ROBUST DISTRIBUTION NETWORK

Our flexible logistics system supports everything from small research batches to large industrial shipments. With in-house warehousing and reliable logistics partners, and having direct connectivity to NH2, makes for an effective and strong distribution.

At Matrexia Advanced Technologies Pvt. Ltd., we produce graphene using a patented mechanical exfoliation process that is completely chemical-free and energy-efficient, generating no toxic byproducts. This makes our method one of the most environmentally friendly approaches to graphene manufacturing today.

WHAT WE OFFER?

FEW-LAYER GRAPHENE (FLG).

Composed of 3–4 graphene layers with over 99% purity, FLG is a highly advanced two-dimensional carbon material, ideal for R&D and industrial applications. It offers exceptional conductivity and mechanical strength due to its few-layer structure.

GRAPHENE POWDER

A fine, dry bulk form of graphene, typically consisting of ≤ 5 layers renowned for its superior electrical, thermal, and mechanical properties, making it suitable for electronics, energy storage, and composite materials.

GRAPHENE NANOPLATELETS (GNP)

GNPs are stacks of several graphene layers (typically 4-7 layers) forming nanoscale, platelet-shaped particles that enhance the mechanical, thermal, and electrical properties of composites and coatings. They disperse easily in matrices, making them valuable for advanced materials and electronics.

WHAT WE OFFER?

GRAPHENE OXIDE (GO)

GO is an oxidized form of graphene, featuring oxygen-containing functional groups that make it highly dispersible in water and polar solvents. It is widely used in solution-based processing, sensors, membranes, and as a precursor for reduced graphene oxide.

REDUCED GRAPHENE OXIDE (rGO)

Produced by reducing GO to remove oxygen groups, rGO regains electrical conductivity and mechanical robustness, though it retains some defects and residual oxygen. It is cost-effective for large-scale applications such as composites, energy storage, and conductive inks.

GRAPHENE DISPERSIONS

These are stable mixtures of graphene flakes or nanoplatelets uniformly distributed in solvents like DI water, IPA, NMP or ethanol, enabling easy processing for coatings, composites, and electronic applications. Dispersions facilitate the integration of graphene into various substrates and matrices.

WHAT WE OFFER?

DISPERSION IN DI WATER

Matrexia Graphene Dispersion in DI Water (500 ml) is a stable, high-purity, water-based graphene solution. It’s ideal for research, coatings, electronics, and composites, offering uniform dispersion, easy handling, and eco-friendly performance.

GRAPHENE CERAMIC COATING

Graphene Ceramic Coating gives a mirror shine and a tough, water-repellent barrier that keeps out dirt and contaminants. Its advanced formula offers scratch resistance, heat protection, and lasting gloss, making surfaces easy to clean and resilient for years.

The Technical Data Sheet

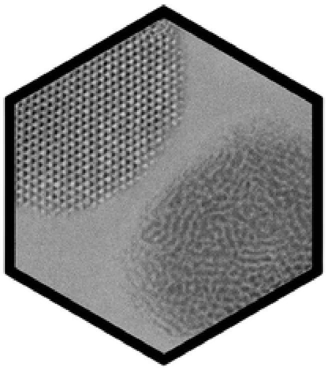
The Technical Data Sheet from Matrexia Advanced Technologies offers an in-depth summary of our advanced material products, serving as a valuable reference for engineers, researchers, and industry professionals. Each sheet includes essential technical specifications such as purity, particle size distribution, number of graphene layers (where applicable), mechanical and thermal properties, as well as recommended applications and handling instructions. Designed to support informed decision-making, our Technical Data Sheets ensure full transparency and help clients select the right material solutions for their unique project requirements.

The following pages present our detailed Technical Data Sheets (TDS), providing comprehensive information on our advanced material products. Please refer to the next page to begin exploring the technical specifications and performance characteristics of our range.

Few Layer Graphene (FLG)

Few-layer graphene (FLG) is a versatile material with applications in electronics, composites, and energy storage.

Product Identification



MATREXIA FLG with large lateral size low oxygen content, high aspect ratio and low defects dry state mechanical exfoliation process. MATREXIA FLG properties make it a suitable solution for improving the specific characteristics of materials and products.

Material Name	Few-Layer Graphene (FLG)
CAS No.	1034343-98-0
Number of layers	3-4 layer graphene
Fixed Carbon Content	98.7–99.6 atomic wt%
Oxygen Content	0.3–1.2 atomic wt%
Lateral Size	10–25 µm
Thickness	< 5 nm (apparent thickness)
Density	0.2 g/cc
Dispersity	Dispersible in NMP, THF, or DMF
Nature	Hydrophobic (contactangle >120°

Key Advantages	No acids/oxidants used, High yield (>90%), Scalable bulk production
Applications	• Conductive coatings and composites • Energy storage(batteries, supercapacitors) • Thermal interface materials • Sensors and electronics
Standards	ISO 9001:2015; ISO 45001: 2018 ; ISO 14001:2015
Safety Notes	• Electrically conductive; avoid dust accumulation near circuits • Non-hazardous understandard handling conditions

Technical Details of Matrexia FLG

1.XRD and Raman Spectraof Matrexia FLG

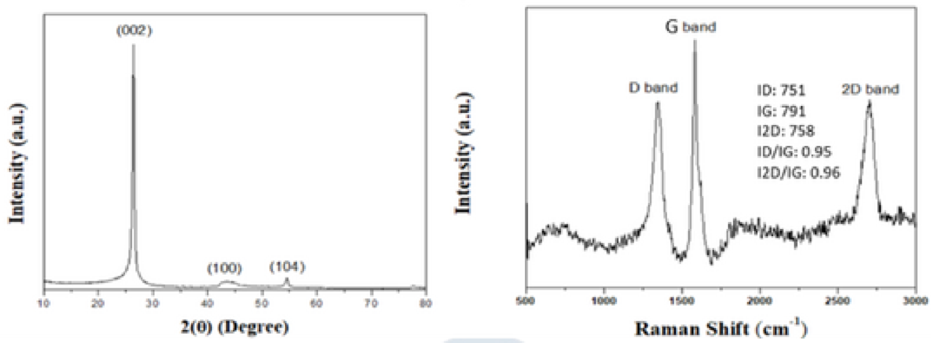


Fig. 1 : XRD and Raman Spectra of Matrexia FLG

Based on the XRD and Raman spectroscopy analysis of the Few Layer Graphene (FLG) material:

- **Crystalline Structure:** XRD analysis shows a prominent (002) reflection peak at ~26-27° 2θ, confirming the characteristic graphitic interlayer spacing and well-ordered crystalline structure typical of high-quality graphene materials.

- **Defect Density:** Raman spectroscopy reveals a D band at ~1350 cm^{-1} with ID/IG ratio of 0.95, indicating moderate defect density and edge effects, which is typical for few-layer graphene with some structural imperfections.

- **Graphitic Quality:** The prominent G band at ~1580 cm^{-1} (IG: 791) demonstrates strong sp^2 carbon bonding characteristic of graphitic materials, confirming the fundamental graphene structure.

- **Layer Thickness Confirmation:** The 2D band at ~2700 cm^{-1} with I2D/IG ratio of 0.96 indicates few-layer graphene structure (typically 3-10 layers), as this ratio is characteristic of multilayer graphene rather than monolayer.

- **Material Purity:** The clean spectral profiles with well-defined peaks and minimal background noise indicate high material purity and good crystalline quality suitable for various applications.

2. Electron Microscopy

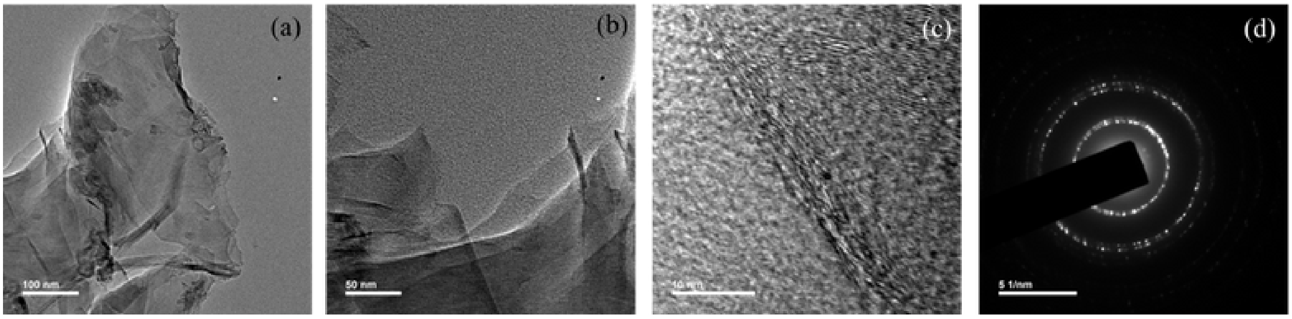


Fig. 2: TEM images of Matrexia FLG (a, b): Bright field images, (c) HR TEM, (d) SAED pattern

TEM Analysis

- **Large-Scale Morphology:** Low magnification TEM (panel a, 100 nm scale) reveals extensive, transparent graphene sheets with well-defined boundaries and minimal structural damage, demonstrating the successful synthesis of large-area FLG materials.

- **Edge Structure Characterisation:** Medium magnification imaging (panel b, 50 nm scale) shows detailed edge morphology with some folding and layer stacking variations, indicating the few-layer nature of the graphene material.

- **Atomic Resolution Imaging:** High-resolution TEM (panel c, 10 nm scale) displays clearly resolved hexagonal lattice structure, confirming the crystalline quality and atomic-level structural integrity of the Matrexia FLG.

- **Crystallographic Confirmation:** Selected area electron diffraction pattern (panel d, 5 1/nm scale) exhibits sharp, well-defined hexagonal diffraction spots with six-fold symmetry, validating the single-crystal nature and high structural quality.

- **Layer Thickness Assessment:** TEM contrast variations across different regions allow identification of monolayer to few-layer areas, confirming the FLG designation with typically 2-10 graphene layers.

FESEM analysis

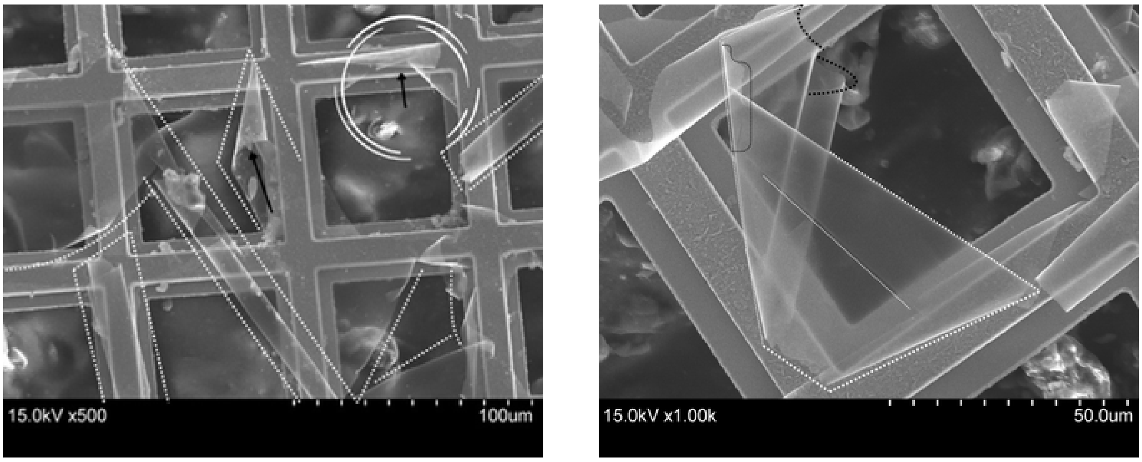


Fig. 3: FESEM images of Matrexia Graphene samples

- **Sample Preparation Method:** FESEM images (Fig. 3) show Matrexia FLG samples dispersed on TEM grid substrate, providing a controlled platform for morphological characterisation at different magnifications.

- **Grid-Scale Distribution:** Low magnification FESEM (15.0kV, x500, 100µm scale) reveals uniform distribution of graphene material across the TEM grid, demonstrating good sample dispersion without significant aggregation.

- **Detailed Grid Structure:** Higher magnification FESEM (15.0kV, x1.00k, 50.0µm scale) shows individual grid openings with graphene sheets spanning across multiple grid squares, indicating large lateral dimensions of the FLG flakes.

- **Surface Topography:** FESEM imaging reveals the three-dimensional nature of graphene sheet placement on the grid, showing both suspended and supported regions that provide insight into mechanical properties.

- **Sample Integrity:** The FESEM analysis confirms that the dispersion process preserves the structural integrity of Matrexia FLG sheets without significant fragmentation or contamination.

Packaging & Storage:

Form	Powder
Storage	Dry, room temperature

KEY FEATURES AND BENEFITS

- verified few-layer graphene
- large lateral size (high thermalconductivity)
- very low oxygen content-high C:O ratio
- largest productioncapacity of few-layergraphene in India
- product free of metalliccontaminants
- batch to batch consistency
- full quality controlon each batch
- scaled production process supporting tonnage orders
- no oxidation, no use of acids or oxidants
- Zero-carbon footprint manufacturing process.

MAIN CONTEST OF APPLICATIONS

- Textiles
- batteries and supercapacitors
- composite materials
- Anti-corrosive coatings and Paints

STORAGE

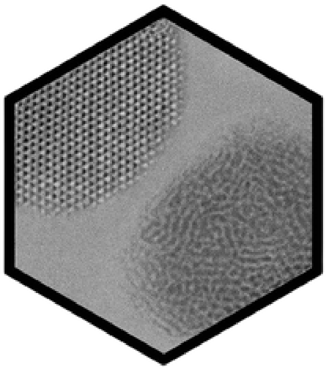
The product should be storedin the original containers, kept tightly closed, and preserved in a clean, dry, andstable environment. The container must be protected from direct sunlight and kept in a dry, cool, and well-ventilated area. The product is not sensitive to freezing.

SHELF LIFE

The shelf life of materialin unopened containers is 48 months from the date of manufacture.

Graphene Nanoplatelet (GNP)

Graphene Nano Platelets (GNP) is another form of graphene with wide range of applications areas.



MATREXIA **GNP** with large lateral size low oxygen content, high aspect ratio and low defects dry state mechanical exfoliation process. MATREXIA **GNP** properties make it a suitable solution for improving the specific characteristics of materials and products.

Material Name	Graphene Nano Platelets (GNP)
CAS No.	1034343-98-0
Number of layers	4-7 layer graphene
Fixed Carbon Content	≥ 99.0 atomic wt%
Oxygen Content	≤1 atomicwt%
Lateral Size	10–20 µm
Thickness	≤ 6 nm (apparent thickness)
Density	0.2 g/cc
Dispersity	Dispersible in NMP, THF, or DMF
Nature	Hydrophobic (contactangle >120°)

Key Advantages	No acids/oxidants used, High yield (>90%), Scalable bulk production
Applications	• Conductive coatings and composites • Energy storage(batteries, supercapacitors) • Thermal interface materials • Sensors and electronics
Standards	ISO 9001:2015; ISO 45001: 2018 ; ISO 14001:2015
Safety Notes	• Electrically conductive; avoid dust accumulation near circuits • Non-hazardous understandard handling conditions

XRD and Raman Spectra of Matrexia GNP

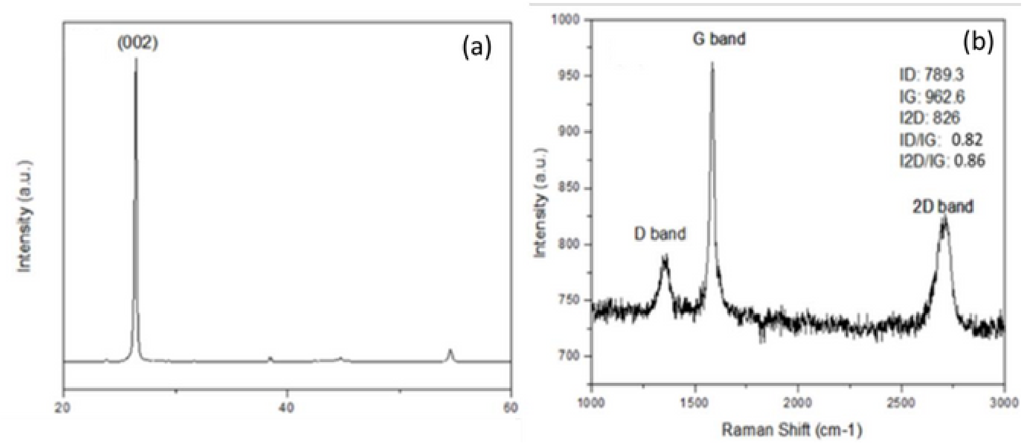


Fig. 1: (a) XRD and (b) Raman spectra of Matrexia Graphene Nano Platelets (GNP)

Based on the XRD and Raman spectroscopy analysis of the Few Layer Graphene (FLG) material:

- **XRD Analysis:** The prominent (002) diffraction peak at approximately 26.5° confirms the layered graphitic structure typical of graphene nanoplatelets, indicating well-ordered carbon layers with interlayer spacing consistent with graphitic materials.

- **Raman G Band:** The sharp G band at ~1580 cm^{-1} demonstrates the presence of sp^2 hybridized carbon atoms in the hexagonal lattice structure, confirming the graphitic nature of the GNP material.

- **Raman D Band:** The D band at ~1350 cm^{-1} indicates structural defects and disorder within the graphene layers, with an ID/IG ratio of 0.82 suggesting moderate defect density typical for commercially produced GNPs.

- **2D Band Characteristics:** The 2D band at ~2700 cm^{-1} with an I2D/IG ratio of 0.86 indicates the material consists of few-layer graphene structures rather than single-layer graphene, which is characteristic of graphene nanoplatelets.

- **Material Quality Assessment:** The combined ID/IG (0.82) and I2D/IG (0.86) ratios suggest the GNP material has reasonable structural quality with controlled defect levels suitable for various applications while maintaining the essential graphitic properties.

- **Structural Confirmation:** Both techniques collectively confirm the material is composed of multi-layer graphene nanoplatelets with preserved sp^2 carbon network and typical graphitic interlayer stacking, validating the product specifications for Matrexia GNP.

2. Electron Microscopic Analysis

Based on the TEM and FESEM characterisation images of Graphene Nano Platelets (GNP), here's a combined analysis of the structural and morphological features:

TEM analysis

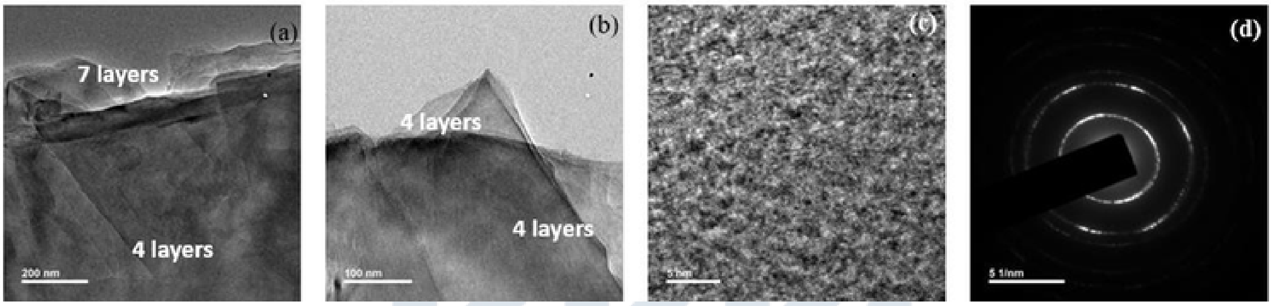


Fig. 2: TEM images of GNP (a, b): Bright field images, (c) HR TEM, (d) SAED pattern

The TEM images provide detailed insight into the layered structure of the GNPs:

Layer Structure: Images (a) and (b) clearly demonstrate the few-layer nature of the graphene nanoplatelets Fig. 2, with distinct layer counts of 4 and 7 layers visible in the edge regions. The layered stacking is characteristic of graphene nanoplatelets, confirming the multi-layer graphitic structure.

High-Resolution Details: Image (c) shows the atomic-scale structure at 5 nm resolution, revealing the ordered carbon lattice arrangement typical of graphene materials.

Crystallographic Confirmation: The Selected Area Electron Diffraction (SAED) pattern in image (d) displays concentric rings characteristic of polycrystalline graphitic materials, confirming the hexagonal crystal structure of the GNP.

FESEM Analysis on TEM Grid

The FESEM images show GNP samples dispersed on a TEM grid support structure, with the characteristic square grid pattern clearly visible.

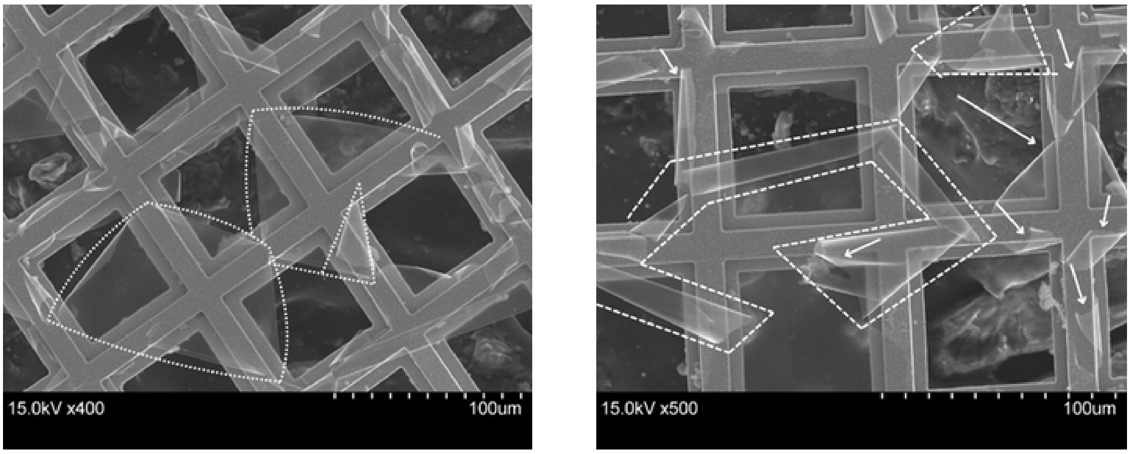


Fig. 3: FESEM images of Matrexia Graphene samples

The graphene nanoplatelets appear as thin, translucent sheet-like structures (outlined with dotted lines) distributed across the grid openings. The regular grid pattern provides an excellent support system for individual platelet characterization, allowing clear visualisation of the GNP morphology at 400x and 500x magnifications.

Combined Analysis

The FESEM-TEM grid approach enables comprehensive characterization by combining the advantages of both techniques. The FESEM provides excellent morphological overview and dispersion quality assessment, while TEM offers atomic-level structural details including layer counting, crystallinity, and defect analysis. The grid-based sample preparation ensures consistent sample support and facilitates correlation between the two imaging techniques for the same sample regions.

KEY FEATURES AND BENEFITS

- verified few-layer graphene
- large lateral size (high thermalconductivity)
- very low oxygen content-high C:O ratio
- largest productioncapacity of few-layergraphene in India
- product free of metalliccontaminants
- batch to batch consistency
- full quality control on each batch
- scaled production process supporting tonnage orders
- no oxidation, no use of acids or oxidants
- Zero-carbon footprint manufacturing process.

Application Area	Example Uses
Electronics	Sensors, PCBs,conductive inks, flexiblecircuits
Composites	Lightweight vehicle parts, aerospace materials, strong plastics
Energy Storage	Li-ion batteries, supercapacitors, current collectors
Coatings & Barriers	Thermal coatings,EMI shielding, packaging films
Textiles & Wearables	Smart fabrics, bulletproof vests,printed electronics
Sensors & Membranes	Biochemical sensors,water purification, environmental adsorbents

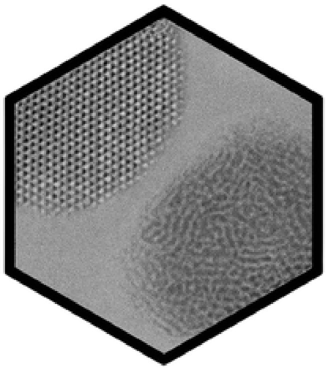
The product should be storedin the original containers, kept tightly closed, and preserved in a clean, dry, and stable environment. The container must be protectedfrom direct sunlight and kept ina dry, cool, and well-ventilated area. The product is not sensitive to freezing.

SHELF LIFE

The shelf life of material in unopened containers is 48 months from the date of manufacture.

Graphene Powder

Graphene Powder (GP) is a versatile material with applications in electronics, composites, and energy storage.



MATREXIA GP with large lateral size low oxygen content, high aspect ratio and low defects dry state mechanical exfoliation process. MATREXIA GP properties make it a suitable solution for improving the specific characteristics of materials and products.

Material Name	Graphene Powder(GP)
CAS No.	1034343-98-0
Number of layers	≤ 5 layers
Fixed Carbon Content	≥ 99 atomic wt%
Oxygen Content	0.3–1.0 atomic wt%
Lateral Size	10–20 µm
Thickness	< 6 nm (apparent thickness)
Density	0.22 g/cc
Dispersity	Dispersible in NMP, THF, or DMF
Nature	Hydrophobic (contact angle >120°)

Key Advantages	No acids/oxidants used, High yield (>90%), Scalable bulk production
Applications	• Conductive coatings and composites • Energy storage(batteries, supercapacitors) • Thermal interface materials • Sensors and electronics
Standards	ISO 9001:2015; ISO 45001: 2018 ; ISO 14001:2015
Safety Notes	• Electrically conductive; avoid dust accumulation near circuits • Non-hazardous understandard handling conditions

Technical Details:

1. XRD and Raman Spectra of Matrexia GP

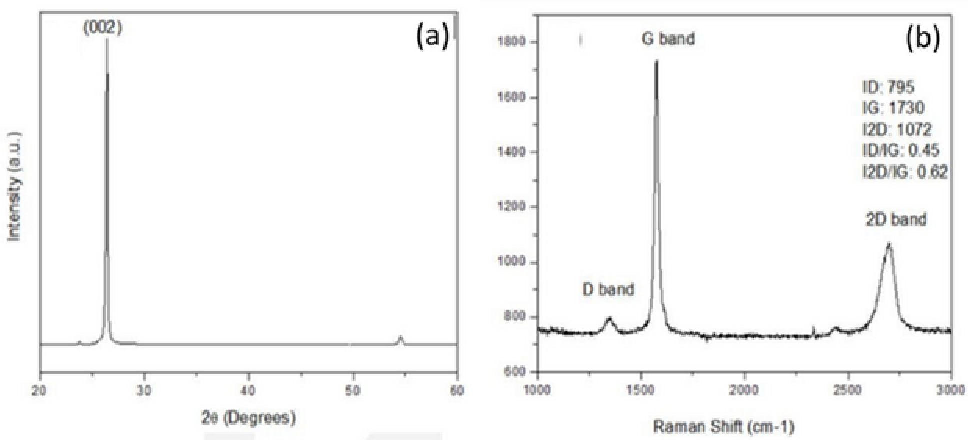


Fig. 1 : XRD (a), and Raman spectra (b) of Matrexia GP

Crystalline Structure Confirmation: XRD shows a sharp, intense (002) peak at ~26° 2θ combined with prominent Raman G band at 1580 cm^{-1}, confirming well-preserved graphitic crystalline structure with strong sp^2 carbon network1

- **Quality Assessment**: ID/IG ratio of 0.45 indicates moderate defect density while the sharp XRD peak suggests good overall crystallinity - material exhibits balanced quality with manageable structural disorder suitable for commercial applications1

- **Layer Structure Identification:** I2D/IG ratio of 0.62 and distinct 2D band at ~2700 cm^{-1} confirms few-layer graphene structure rather than single-layer, supported by the characteristic (002) interlayer spacing from XRD analysis1

- **Material Purity:** Both techniques show clean spectra with minimal impurity peaks - XRD displays predominantly graphitic phase while Raman confirms carbon-based material without significant contamination or oxidation products1

- **Application Suitability**: Combined data indicates high-quality graphene powder with sufficient conductivity (strong G band), reasonable structural integrity (sharp XRD peak), and controlled defect levels appropriate for electronic, composite, and coating applications

2. Electron Microscopic Characterisations

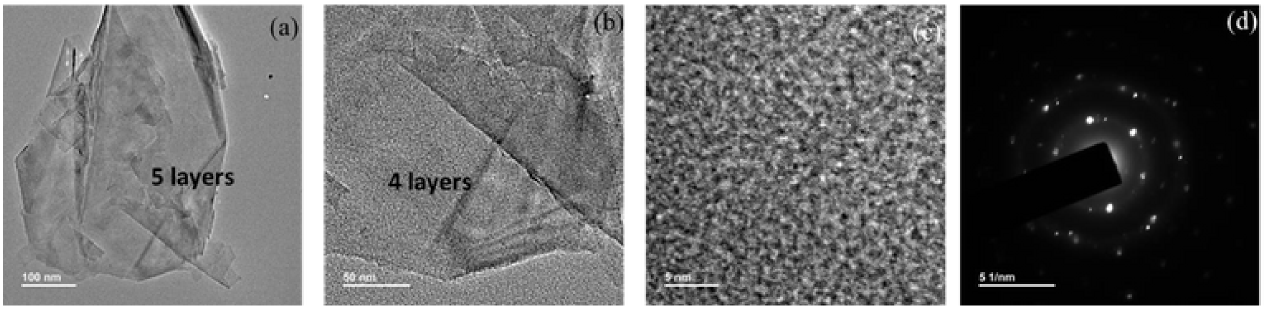


Fig. 2 Transmission Electron Microscopy (TEM) of MATREXIAGP(a, b): Bright field, (c) HR TEM and (d) SAED pattern of Matrexia Graphene powder.

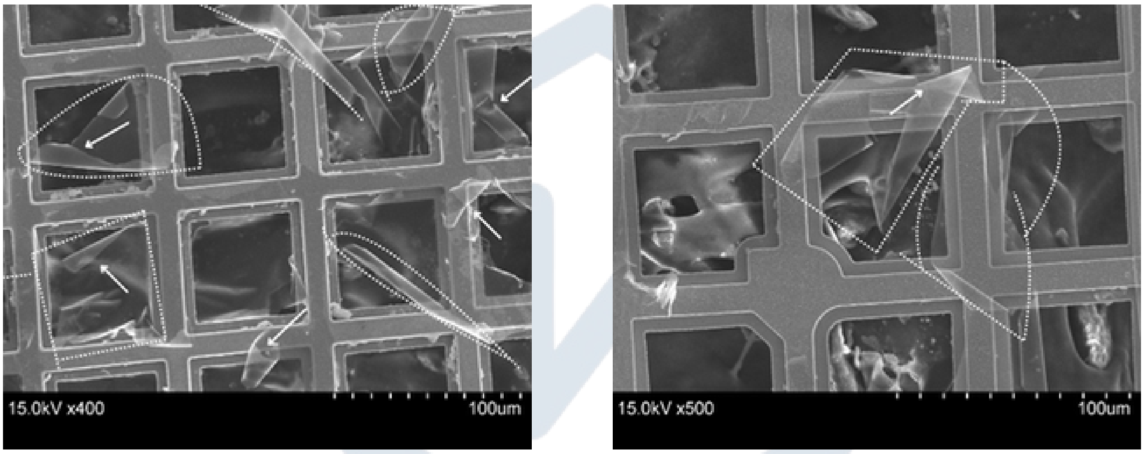


Fig. 3 FESEM images of Matrexia GP

Electron microscopic analysis

- **Layer Structure Confirmation:** TEM images clearly reveal few-layer graphene sheets with distinct 4-5 layer stacking visible at nanoscale resolution, confirming the multi-layer nature previously indicated by spectroscopic analysis (I2D/IG ratio of 0.62).

- **Crystalline Quality and Defects:** TEM diffraction pattern shows well-defined hexagonal spots indicating preserved crystalline structure, while high-resolution imaging reveals some edge defects and wrinkles typical of mechanically exfoliated graphene powder.

- **Sample Dispersion and Grid Analysis**: FESEM images of graphene powder dispersed on TEM grid demonstrate uniform distribution across the grid squares, with individual graphene flakes clearly visible within the 100µm grid openings, confirming successful sample preparation for electron microscopy analysis.

- **Particle Size and Distribution**: Combined imaging reveals graphene flakes ranging from sub-micrometer to several micrometers in lateral dimensions, with FESEM showing the overall size distribution while TEM provides detailed thickness measurements of individual sheets.

- **Morphological Assessment**: TEM confirms thin, transparent graphene sheets with minimal folding, while FESEM demonstrates good dispersion characteristics without significant agglomeration, indicating suitable powder properties for various application requirements.

Packaging & Storage:

Form	Powder
Storage	Dry, room temperature

KEY FEATURES AND BENEFITS

- verified few-layer graphene
- large lateral size (high thermalconductivity)
- very low oxygen content-high C:O ratio
- largest productioncapacity of few-layergraphene in India
- product free of metalliccontaminants
- batch to batch consistency
- full quality control on each batch
- scaled production process supporting tonnage orders
- no oxidation, no use of acids or oxidants
- Zero-carbon footprint manufacturing process.

MAIN CONTEST OF APPLICATIONS

Our advanced materials are engineered for high performance and are ideally suited for use in:

- Textiles – Enhancingdurability, flexibility, and functionality
- Energy Storage – Optimizing performance in batteries and supercapacitors
- Composite Materials – Improving strength-to-weight ratio and thermal stability
- Paints & Coatings – Providing superior protection, conductivity, and aesthetics

STORAGE

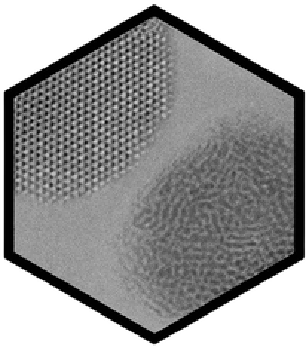
The product should be stored in the original containers, kept tightly closed,and preserved in a clean, dry, and stable environment. The container must be protected from direct sunlightand kept in a dry, cool, and well-ventilated area. The product is not sensitive to freezing.

SHELF LIFE

The shelf life of material in unopened containers is 48 months from the date of manufacture.

Graphene Oxide (GO)

Graphene Oxide (GO) is a versatile material with applications in electronics, composites, and energy storage. Product Identification



MATREXIA Graphene oxide (GO) is a single-layer derivative of graphene that contains oxygen-rich functional groups such as hydroxyl, epoxide, and carboxyl groups. These functional groups make GO highly dispersible in water and other solvents, enabling easy processing and chemical modification. While it is less conductive than pure graphene, its unique structure and surface chemistry make it ideal for applications in membranes, sensors, biomedical devices,

Material Name	Graphene Oxide (GO)
CAS No.	7782-42-5
Number of layers	3-4 layer graphene
Fixed Carbon Content	45–75 atomic wt%
Oxygen Content	25–45 atomic wt%
Lateral Size	10–25 µm
Thickness	< 5 nm (apparent thickness)
Density	~1.8 g/cc
Dispersity	Dispersible in NMP, THF, or DMF
Nature	Hydrophilic (contact angle <60°)

Key Advantages	Rich in oxygen-containing functional groups for chemical modification, Excellent aqueous dispersibility. Ideal precursor for reduced graphene oxide (rGO)
Applications	• Water purification membranes • Biomedical delivery systems • Flexible sensors and biosensors • Reinforced hydrogels and composites
Standards	ISO 9001:2015; ISO 45001: 2018 ; ISO 14001:2015
Safety Notes	• Stable and non-conductive in dry form; conductivity increases upon reduction • Handle dry powder with care to prevent inhalation • Non-flammable and non-toxic under normal laboratory conditions

Technical Details:

1. XRD and Raman Spectra of Matrexia GO

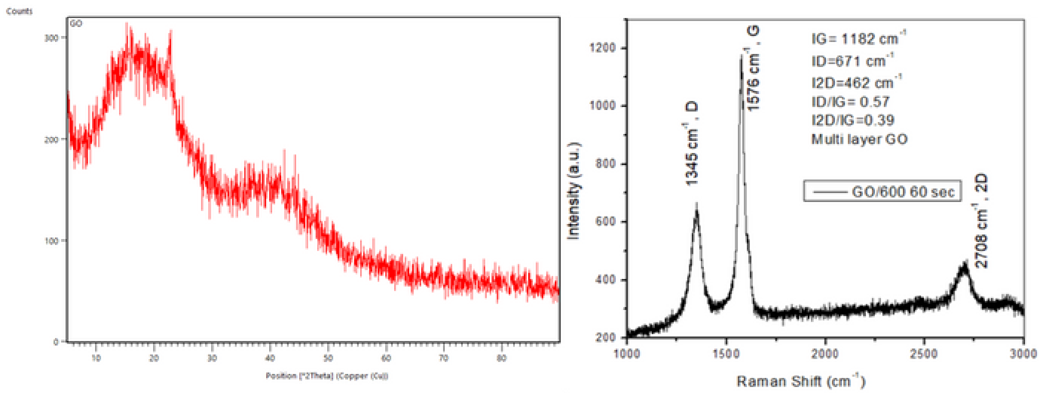


Fig.1. (a) XRD and (b) Raman spectra of Matrexia Graphene Oxide (GO)

- **Structural Analysis – XRD (Left):** The X-ray diffraction (XRD) pattern of graphene oxide exhibits a broad peak centered around ~11–12° (2θ), corresponding to the (001) plane. This shift from the typical graphitic (002) peak (~26°) confirms the successful oxidation and interlayer expansion due to the insertion of oxygen-containing functional groups and water molecules. The broadness and lower intensity reflect the amorphous and disordered nature of GO sheets.

- **Defect Characterization – Raman Spectroscopy (Right):** The Raman spectrum reveals a pronounced D band at ~1345 cm^{-1} and G band at ~1576 cm^{-1}, typical of graphene oxide. The I_D/I_G ratio of 0.57 indicates a moderate density of defects, primarily due to sp^3 carbon centres and structural disorders introduced during oxidation.

- **Graphitic Backbone – G Band Insight**: The G band signifies sp^2-hybridized carbon vibrations, confirming the presence of retained graphitic domains within the GO structure. This band is essential for identifying the extent of conjugated carbon networks after oxidation.

- **Layer and Structural Disorder –** 2D Band Insight: A weak 2D band appears at ~2708 cm^{-1}, indicating multilayer graphene oxide with disrupted stacking order. The I_2D/I_G ratio of 0.39 is consistent with few-to-multilayer GO sheets having significant interlayer spacing and structural distortion.

- **Material Classification:** The combination of broad XRD peaks and distinct Raman bands confirms that the sample is multilayer graphene oxide with partial structural integrity, oxygen-rich composition, and suitability for further chemical reduction or functional application in areas such as composites, membranes, and sensors.

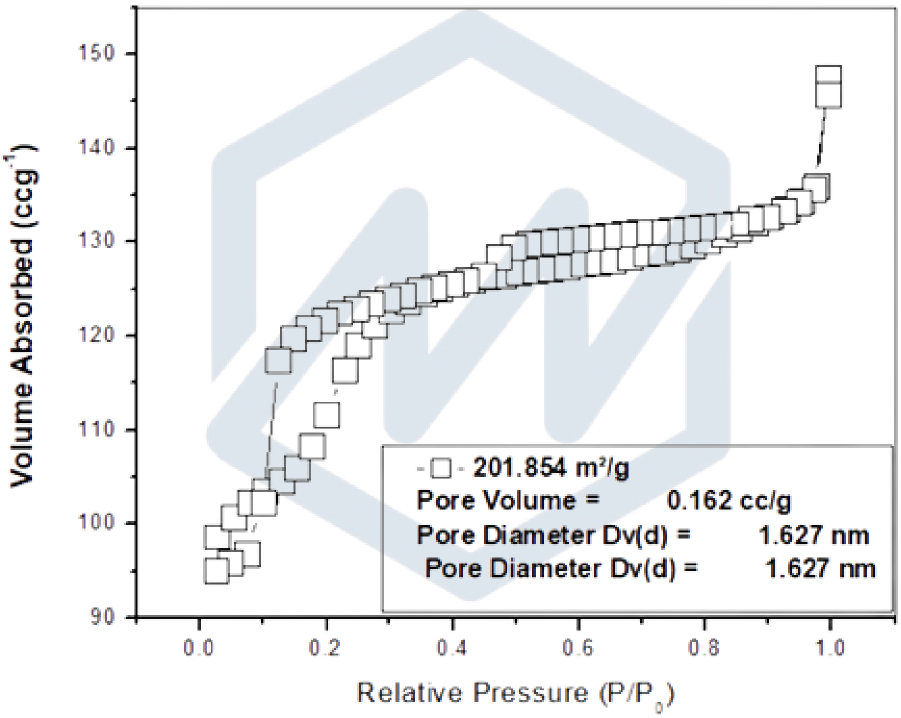


Fig. 2: BET Surface Area analysis of GO

2. BET Surface Area Analysis

- **Fig. 2** measures GO's specific surface area via the Brunauer–Emmett–Teller (BET) method. GO exhibits a high surface area (exact value dependent on synthesis),
- Crucial for applications in: Adsorption (e.g., water purification).

- Catalysis, where larger surface areas enhance reactivity.

- Energy storage, as electrodes in supercapacitors or batteries

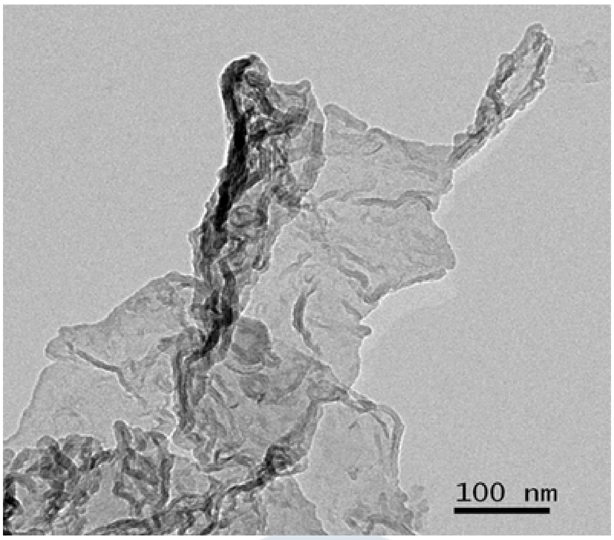


Fig. 3. TEM images of Matrexia Graphene Oxide.

3. TEM Analysis of Graphene Oxide (GO)

- **Morphology Overview:** The low-magnification TEM image (scale: 100 nm) reveals ultrathin, semi-transparent sheets of graphene oxide with wrinkled and crumpled morphology. The extended lateral dimensions and thin film appearance indicate successful exfoliation and synthesis of large-area GO flakes.

- **Edge Structure and Folding:** The image exhibits irregular edges and folding, common in GO due to its oxygenated functional groups and high flexibility. These folds provide insight into the mechanical compliance and layer stacking behavior of GO sheets.

- **Layer Identification:** The varying contrast intensity across the sheet suggests a few-layer structure (typically 1–5 layers), with darker regions corresponding to overlapping layers. This characteristic confirms the partial restacking often observed during GO sample preparation.

- **Surface Texture and Transparency:** The transparent nature of the flakes under TEM conditions reflects the atomically thin structure of GO. The sheets show no evidence of heavy agglomeration or fragmentation, demonstrating good dispersion quality.

- **Material Insight:** This TEM observation confirms that the synthesized GO retains structural integrity, sheet continuity, and nanoscale thinness, making it ideal for applications in membranes, biomedical scaffolds, sensors, and composite reinforcement**.**

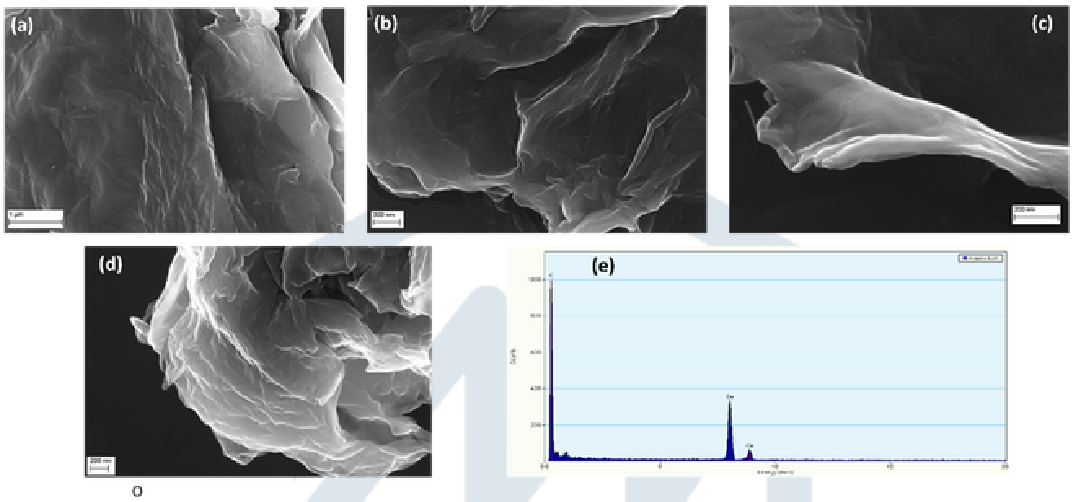


Fig.4: FESEM (a to d) and EDX (e) photomicrograph of GO

4. Morphological and Elemental Analysis

FESEM and EDX Analysis of Graphene Oxide (GO)

- **Morphological Characterization:** The FESEM images show wrinkled, ultrathin sheet-like morphology of graphene oxide at various magnifications. The layered, accordion-like structures with sharp edges and folds are typical for GO, resulting from the presence of oxygen-containing functional groups that induce sheet distortion and interlayer repulsion.
- **Magnification Details:**
- (a) At low magnification (scale: 1 µm), large, stacked GO sheets are observed, highlighting their extended lateral dimensions and sheet continuity.
- (b & c) Medium magnification (scales: 500 nm and 200 nm, respectively) reveals curled and crumpled surfaces, indicating the flexibility and high surface area of the GO sheets.
- (d) At higher magnification (200 nm scale), thin, translucent edges can be seen, signifying few-layer sheet thickness with uniform morphology.

- Structural Insights: The observed wrinkles and folds are indicative of good exfoliation and suggest mechanical robustness. The 3D texture and undulating surfaces confirm GO's potential for use in membranes, coatings, and composites where surface interaction is critical.

- Elemental Composition – EDX Spectrum: The energy-dispersive X-ray spectroscopy (EDX) analysis confirms the elemental presence of carbon (C) and oxygen (O), validating the oxygen-functionalized nature of graphene oxide. The dominant carbon peak with a secondary oxygen peak aligns with the expected composition of GO. The copper (Cu) peak likely originates from the substrate grid or sample holder.

- Sample Purity and Integrity: The FESEM analysis shows no visible contaminants or agglomerates, indicating high purity and uniform dispersion. The exfoliation and drying processes effectively preserve the sheet structure of graphene oxide.

5. Comparative Summary of Techniques

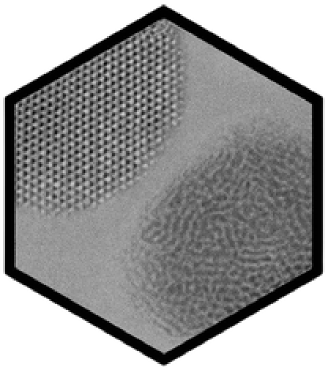
FESEM and EDX Analysis of Graphene Oxide (GO)

Method	Key Insights	Application Relevance
XRD	Interlayer spacing (0.74–0.89 nm), crystallinity loss due to oxidation	Quality control of oxidation degree
Raman	Defect density (ID/IG ratio), graphitic domain integrity	Tuning electrical/ mechanical properties
BET	High surface area for adsorption/catalysis	Optimizing performance in functional uses
FESEM/EDX	Sheet morphology, elemental composition (C/O ratio)	Purity assessment and structural defects
TEM	Layer thickness, atomic-scale defects, reduction dynamics	Real-time behavior under stimuli

This comprehensive characterization confirms GO's structural and functional properties, enabling tailored use in nanocomposites, sensors, and energy devices

Reduced Graphene Oxide (rGO)

Reduced Graphene Oxide (rGO) is a versatile material with applications in electronics, composites, and energy storage.



MATREXIA rGO with large lateral size low oxygen content, high aspect ratio and low defects dry state mechanical exfoliation process. MATREXIA rGO properties make it a suitable solution for improving the specific characteristics of materials and products.

Material Name	reduced Graphene Oxide (rGO)
CAS No.	1034343-98-0
Number of layers	≤ 8 layers
Fixed Carbon Content	85-90 atomic wt%
Oxygen Content	10-14.5 atomic wt%
Lateral Size	10–20 µm
Thickness	< 9 nm (apparent thickness)
Density	0.22 g/cc
Dispersity	Dispersible in NMP, THF, or DMF
Nature	Hydrophobic (contact angle >120°)

Key Advantages	No acids/oxidants used, High yield (>90%), Scalable bulk production
Applications	• Conductive coatings and composites • Energy storage(batteries, supercapacitors) • Thermal interface materials • Sensors and electronics
Standards	ISO 9001:2015; ISO 45001: 2018 ; ISO 14001:2015
Safety Notes	• Electrically conductive; avoid dust accumulation near circuits • Non-hazardous understandard handling conditions

Technical Details of Matrexia rGO

1. XRD and Raman Spectra of Matrexia rGO

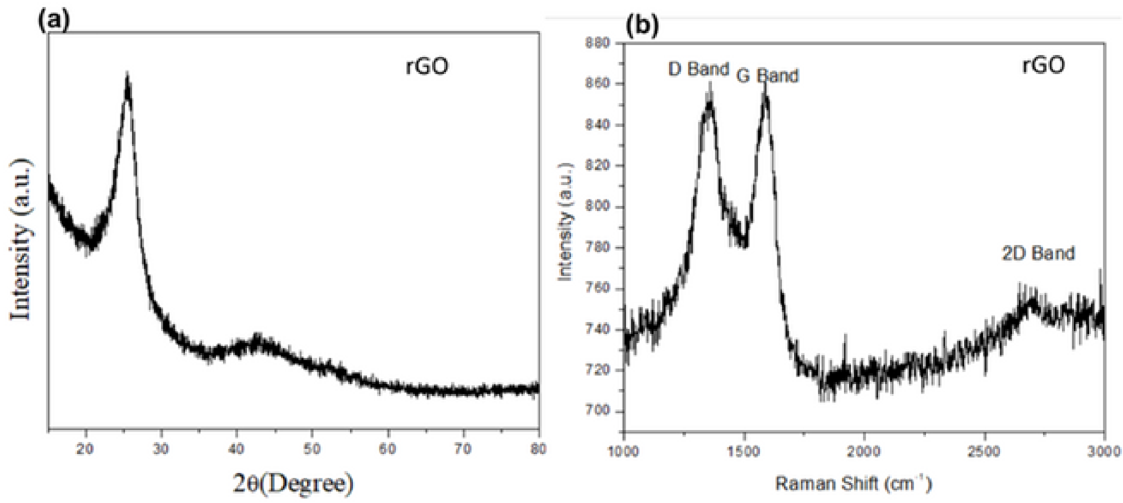


Fig.1. (a) XRD and (b) Raman spectra of Matrexia Graphene Oxide (GO)

- **Interlayer Structure – XRD Analysis** :The X-ray diffraction (XRD) pattern of rGO displays a broad peak around ~24–25° (2θ) corresponding to the (002) plane, indicating increased interlayer spacing due to residual oxygen functionalities and partial restacking of reduced graphene oxide sheets. The broadness of the peak suggests amorphous or turbostratic disorder, characteristic of chemically reduced graphene oxide.

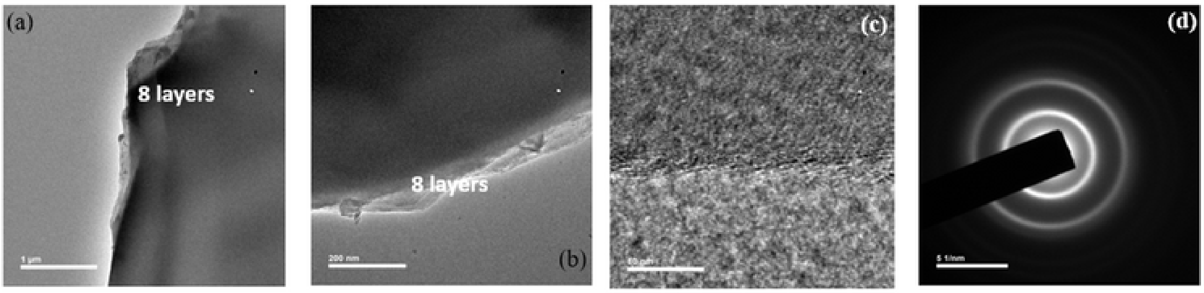
- **Defect Structure – Raman Spectroscopy**: Raman analysis shows a strong D band (~1350 cm^{-1}) and G band (~1580 cm^{-1}). The I_D/I_G ratio > 1 reflects a high density of defects and edge sites introduced during the oxidation-reduction process, confirming successful reduction of GO while retaining structural imperfections essential for certain applications (e.g., sensing, catalysis).

- **Graphitic Features**: The G band corresponds to the E_2g phonon of sp^2 carbon atoms, indicating the partial restoration of the graphitic network. Despite defects, the sp^2 domains are sufficiently retained to ensure electrical conductivity.

- **Layer Structure – 2D Band:** A weak and broad 2D band (~2700 cm^{-1}) confirms the few-layer nature of rGO with disordered stacking. The absence of a sharp 2D peak typical of monolayer graphene reinforces the multilayer and partially disordered structure of rGO.

- **Material Quality:** The well-defined Raman peaks and interpretable XRD pattern suggest that the rGO sample has undergone effective reduction, with recovered graphitic order, tunable defect density, and layered morphology, making it suitable for a wide range of applications in energy storage, electronics, and coatings.

Transmission Electron Microscopy (TEM) of MATREXIA rGO



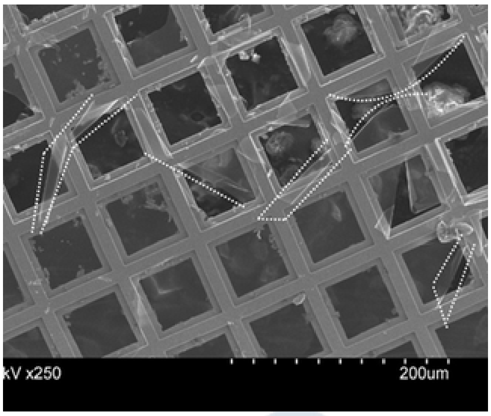
- **Layer Thickness Visualization:** Low-magnification TEM image (scale: 1 µm) reveals stacked, crumpled sheet-like morphology characteristic of reduced graphene oxide. Approximately 8 layers are visible at the edge, confirming few-layer rGO formation. The sheets exhibit partial transparency, suggesting thin-layered structure.

- **Edge Structure and Layering**: Medium-magnification TEM (scale: 200 nm) provides a closer look at the layered edges, showing distinct stacking and flake edges. The folding and wrinkling indicate flexibility and interlayer van der Waals interactions, common in rGO morphology.

- **Interlayer Structure:** High-resolution TEM image (scale: 5 nm) displays the turbostratic stacking and disrupted lattice ordering due to residual oxygen functionalities. While partial graphitic alignment is observed, the structure reflects typical rGO properties with improved conductivity over GO but less crystallinity than pristine graphene.

- **Crystallinity Analysis**: The selected area electron diffraction (SAED) pattern shows diffuse concentric rings, indicating polycrystalline nature of rGO with multiple disoriented graphene domains. This is consistent with partial restoration of sp^2 domains after chemical or thermal reduction of GO.

FESEM analysis:



- **Sample Preparation:** The FESEM image illustrates rGO flakes dispersed on a microfabricated TEM support grid, enabling systematic observation of morphology and lateral spread. The preparation preserves sheet structure and minimizes aggregation during deposition.

- **Grid-Scale Distribution:** At low magnification (15.0 kV, ×250, 200 µm scale), the rGO sheets are seen bridging across multiple grid openings, highlighting their large lateral dimensions and flexibility. The uniform distribution suggests good exfoliation and dispersion of the rGO material.

- **Flake Morphology and Suspension Behavior**: The rGO flakes appear partially suspended across the mesh, with distinct wrinkling and folding visible in several regions. This suspension behavior is typical for ultrathin, few-layer rGO sheets and provides qualitative insights into their mechanical robustness and surface tension interactions.

- **Surface Features and Cleanliness:** No signs of severe agglomeration or major contaminants are observed, indicating good sample purity and clean processing conditions. Minor surface texture and curvature are visible, typical of reduced graphene oxide's flexible morphology.

- **Material Integrity and Lateral Spread:** The observed morphology confirms that the reduction and dispersion processes preserve the 2D sheet integrity of rGO. The flake sizes span several tens to hundreds of microns, ideal for applications in transparent films, conductive coatings, and membranes.

Packaging & Storage:

Form	Powder
Storage	Dry, room temperature

KEY FEATURES AND BENEFITS

- Verified Few-Layer: Consistently high-quality few-layer rGO, validated for performance and reliability.
- Exceptional Thermal Conductivity: Large lateral sheet dimensions ensure superior thermal performance.
- Ultra-Low Oxygen Content: High carbon-to-oxygen (C:O) ratio guarantees excellent electrical and structural properties.
- India's Leading Production Capacity: The highest output of few layer rGO in the country
- Metal-Free Purity: Completely free from metallic contaminants.
- Batch-to-Batch Consistency: Rigorous quality assurance ensures uniformity across all production lots.
- Comprehensive Quality Control: Each batch undergoes thorough characterization and testing.
- Scalable for Industry: Robust manufacturing capability supports tonnage-scale orders.
- Chemical-Free Process: Produced without oxidation, acids, or oxidizing agents.
- Eco-Friendly Manufacturing: Zero-carbon footprint and sustainable production methods

AREA OF APPLICATIONS

- ## Energy Storage:

- Lithium-ion and sodium-ion battery electrodes
- Supercapacitor electrodes
- Fuel cell components

- ## Composites & Coatings:

  - Reinforcement in polymers, rubbers, and resins
  - Anti-corrosion and conductive coatings
  - Thermal interface materials

- ## Electronics & Sensors:

  - Flexible and printed electronics
  - Transparent conductive films
  - Chemical, biological, and gas sensors

- ## Water Treatment & Filtration:

  - Membranes for desalination and purification
  - Adsorbents for heavy metal and dye removal

- ## Biomedical:

  - Drug delivery systems
  - Antibacterial coatings
  - Bioimaging and biosensors

- ## Additive Manufacturing:

  - Conductive 3D printing filaments
  - Smart and functional materials

- ## Thermal Management:

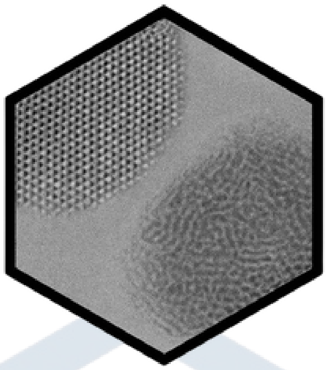
  - Heat dissipation materials in electronics
  - Thermal conductive fillers in adhesives and greases

STORAGE

The product should be stored in the original containers, kept tightly closed, and preserved in a clean, dry, and stable environment. The container must be protected from direct sunlight and kept in a dry, cool, and well-ventilated area. The product is not sensitive to freezing.

Graphene Dispersion

Graphene Dispersion formulated with high-purity graphene sheets suspended in N-Methyl-2-pyrrolidone (NMP), this dispersion delivers exceptional stability, superior conductivity, and excellent compatibility with various substrates and polymers.



Matrexia Graphene Dispersion in NMP (1 Litre) is a premium-quality, industrial-grade solution crafted for high-performance applications across electronics, energy, coatings, and nanotechnology sectors.

Material Name	Graphene Dispersion
CAS No.	1034343-98-0
Composition:	Graphene-reinforced ceramic resin
Physical State:	Liquid
Application Method:	Spray, wipe, or brush
Application Surfaces:	Paint, glass, headlights, chrome, wheels, trim, bed liners

PRODUCT FEATURES:

- High Graphene Concentration – For maximum performance in electronic and chemical systems
- Excellent Dispersion Stability – Long-lasting, homogenous suspension in NMP
- Industrial & Lab Grade – Suitable for research labs, pilot projects, and commercial production
- Low Particle Size (<5µm) – Ensures uniform coating and blending properties
- Long Shelf Life – Up to 12 months in sealed container

MAIN CONTEST OF APPLICATIONS

- Energy Storage Devices (Supercapacitors, Li-ion Batteries)
- Conductive and Anti-static Coatings
- Flexible Electronics & Printed Circuits
- Thermally Conductive Composites
- Polymer Reinforcement and Advanced Resins

STORAGE

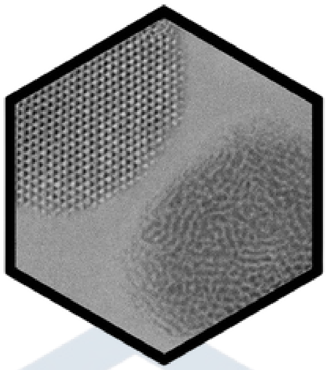
The dispersion should be stored in original, tightly sealed containers in a dry, cool, and well-ventilated area, away from direct sunlight and ignition sources. Ensure the environment is clean and stable for optimal preservation.

SHELF LIFE

Unopened containers have a shelf life of 48 months from the date of manufacture.

Graphene Dispersion in DI Water

Graphene Dispersion in DI Water formulated using exfoliated high-purity graphene in deionized water, it offers excellent stability, uniform dispersion, and safe handling – making it ideal for sustainable and non-toxic material solutions.



Matrexia Graphene Dispersion in DI Water (500 ml) is a high-quality, water-based graphene solution designed for cutting-edge applications in research, coatings, electronics, and composites.

Material Name	Graphene Dispersion in DI Water
CAS No.	1034343-98-0
Composition:	Graphene-reinforced ceramic resin
Physical State:	Liquid
Application Method:	Spray, wipe, or brush
Application Surfaces:	Paint, glass, headlights, chrome, wheels, trim, bed liners

PRODUCT FEATURES:

- Eco-Friendly Water-Based Dispersion – Safe for lab and industrial use
- High Electrical & Thermal Conductivity – Suitable for electronics and functional coatings
- Fine Particle Size (<5µm) – Enables smooth, even surface integration
- Stable & Ready to Use – No need for further dilution or processing
- Non-Hazardous – No harmful solvents or emissions

MAIN CONTEST OF APPLICATIONS

- Conductive Water-Based Inks & Paints
- Flexible and Printed Electronics
- Sensors, Biosensors & Lab Research
- Coatings for Anti-Corrosion & EMI Shielding
- Polymer & Composite Reinforcement

STORAGE

The dispersion in DI water should be stored in original, tightly sealed containers in a dry, cool, and well-ventilated area, away from direct sunlight and ignition sources. Ensure the environment is clean and stable for optimal preservation.

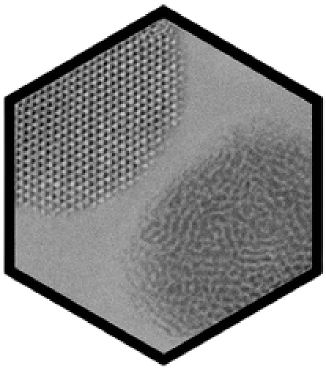
SHELF LIFE

Unopened containers have a shelf life of 48 months from the date of manufacture.

Graphene Ceramic Coating

Graphene Ceramic Coating is a versatile material with applications in electronics, composites, and energy storage.

Product Identification



MATREXIA FLG, with large lateral size, low oxygen, and minimal defects, is produced by dry mechanical exfoliation. This makes it ideal for Graphene Ceramic Coating, boosting durability, thermal conductivity, and surface protection for outstanding long-term results.

Material Name	Graphene Ceramic Coating
CAS No.	1034343-98-0
Composition:	Graphene-reinforced ceramic resin
Physical State:	Liquid
Application Method:	Spray, wipe, or brush
Application Surfaces:	Paint, glass, headlights, chrome, wheels, trim, bed liners

Key Advantages	Superior durability, enhanced gloss, and exceptional resistance to scratches, chemicals, and UV rays.
Applications	• Automotive Surfaces • Industrial Equipment • Consumer Electronics • Architectural and Construction • Aerospace and Marine
Standards	ISO 9001:2015; ISO 45001: 2018 ; ISO 14001:2015
Safety Notes	• Electrically conductive; avoid dust accumulation near circuits • Non-hazardous understandard handling conditions

Packaging & Storage:

Form	Liquid
Storage	Dry, room temperature

KEY FEATURES AND BENEFITS

- Advanced graphene-reinforced ceramic matrix for superior surface protection
- Exceptional scratch, abrasion, and chemical resistance
- High thermal stability and UV protection
- Hydrophobic and self-cleaning properties for easy maintenance
- Long-lasting, mirror-like gloss and enhanced color depth
- Consistent performance with batch-to-batch quality control
- Free from acids, oxidants, and harmful additives
- Scalable production for industrial and automotive applications
- Environmentally friendly, zero-carbon footprint manufacturing process

MAIN CONTEST OF APPLICATIONS

- Automotive paint and surface protection
- Industrial machinery and equipment coatings
- Marine and aerospace surface treatments
- Consumer electronics and appliance finishes
- Architectural glass and metal protection

STORAGE

The coating should be stored in original, tightly sealed containers in a dry, cool, and well-ventilated area, away from direct sunlight and ignition sources. Ensure the environment is clean and stable for optimal preservation.

SHELF LIFE

Unopened containers have a shelf life of 48 months from the date of manufacture.

WE ARE THE DIFFERENCE

Matrexia Advanced Technologies PVT LTD, is not just any other company where graphene is one of the products of a huge product list. We are solely focused on extracting the purest and thinnest layer of graphene. Our rigorous quality control systems and full compliance with global standards, ensuring our clients receive materials that meet the highest benchmarks of performance and reliability. Our deep, specialized expertise in applying graphene across a wide range of industries ranging from electronics and energy storage to aerospace, coatings, and biomedicine.

Customized Solutions for Every Sector

At Matrexia, we recognize the unique challenges of each sector and tailor our graphene solutions to deliver measurable value and a technological edge.

Collaborative Innovation and Real-Time Advancements

Our innovation is powered by strong collaborations with leading academic institutions and industry partners, keeping us aligned with real-time advancements.

Knowledge-Driven Leadership and Future-Ready Solutions

Backed by a diverse, knowledge-driven leadership team—spanning scholars, engineers, and marketing experts—we stay ahead of market needs to offer future-ready, reliable solutions. We don't follow trends; we build long-term solutions for society.

Why Graphene matters?

UNLOCKING THE POTENTIAL OF A REVOLUTIONARY MATERIAL

01

THE WONDER MATERIAL

Graphene is often dubbed the “wonder material.” It is set to revolutionize nearly every major industry, including

- Healthcare
- Electronics
- Energy
- Construction

02

EXCEPTIONAL PHYSICAL PROPERTIES

- Just one atom thick.
- 200 times stronger than steel.
- More conductive than copper.
- Combines extreme strength, flexibility, and efficiency—unmatched by any other material.

03

UNIQUE PROPERTIES DRIVING INNOVATION

- Transparency
- Impermeability
- Self-repair capabilities
- Biocompatibility

04

APPLICATIONS ACROSS SECTORS

1. Electronics:
- Enables ultra-fast, flexible devices.
- Powers smarter, more efficient circuits.

2. Energy:
- Powers longer-lasting batteries.
- Enables rapid-charging supercapacitors.
- Improves solar panel efficiency.

WHERE WE OPERATE?

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