

TECHNICAL DATA SHEET

Single Layer Graphene

Dispersible monolayer graphene — powder and DI-water dispersion · CAS 7782-42-5



ACS Material Single Layer Graphene (500 mg bottle shown)

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SECTION I

Product Overview

Single layer graphene is incredibly lightweight yet highly durable, and conducts a high level of electricity through a minuscule amount of material. ACS Material single layer graphene is supplied in two forms: a high-surface-area powder and a ready-to-use 1 mg/mL dispersion in DI water. Both forms are metal-ion free and serve as conductive agents that help improve the high-rate charge-discharge capacity of batteries, with further use in supercapacitors, lead-acid cells, solar cells, semiconductor work, graphene films, coatings, and biomaterials research.

The powder is produced by a combination of thermal exfoliation reduction and hydrogen reduction; the dispersion is prepared via our own mechanical stripping and dispersion method. Dispersible single layer graphene is obtained by completely reducing graphene oxide made by the modified Hummers method. Conventional routes tend to yield a denser graphene that agglomerates, and the resulting aggregates are neither soluble nor redispersable in water or other polar solvents, which makes further processing difficult. ACS Material's dispersible graphene avoids this problem and can be redispersed in most solvents with the help of sonication.

Product Features

- **Monolayer flakes** — 0.6–1.2 nm thickness at 0.4–5 μm flake diameter.
- **High surface area** — BET surface area of 400–1000 m^2/g for abundant electrochemically active interface.
- **Highly conductive** — electrical resistivity $\leq 0.30 \Omega\cdot\text{cm}$ supports conductive-agent use at very low loadings.
- **Metal-ion free** — both powder and dispersion suit battery slurries and high-rate electrodes.
- **Redispersible** — ultra-low-density ($\sim 0.01 \text{ g}/\text{cm}^3$) powder re-disperses in most solvents with sonication.
- **Two supply forms** — powder for solvent-flexible formulation, or 1 mg/mL DI-water dispersion for aqueous work.

SECTION II

Specifications

Table 1 — Single Layer Graphene Powder

Single Layer Graphene Powder / Monolayer Graphene Powder	
Flake Diameter (μm)	0.4–5
Thickness (nm)	0.6–1.2
BET Surface Area (m^2/g)	400–1000
Electrical Resistivity ($\Omega\cdot\text{cm}$)	≤ 0.30
Density	$\sim 0.01 \text{ g}/\text{cm}^3$
Dispersible Property	Can be re-dispersed in most solvents with the help of sonication

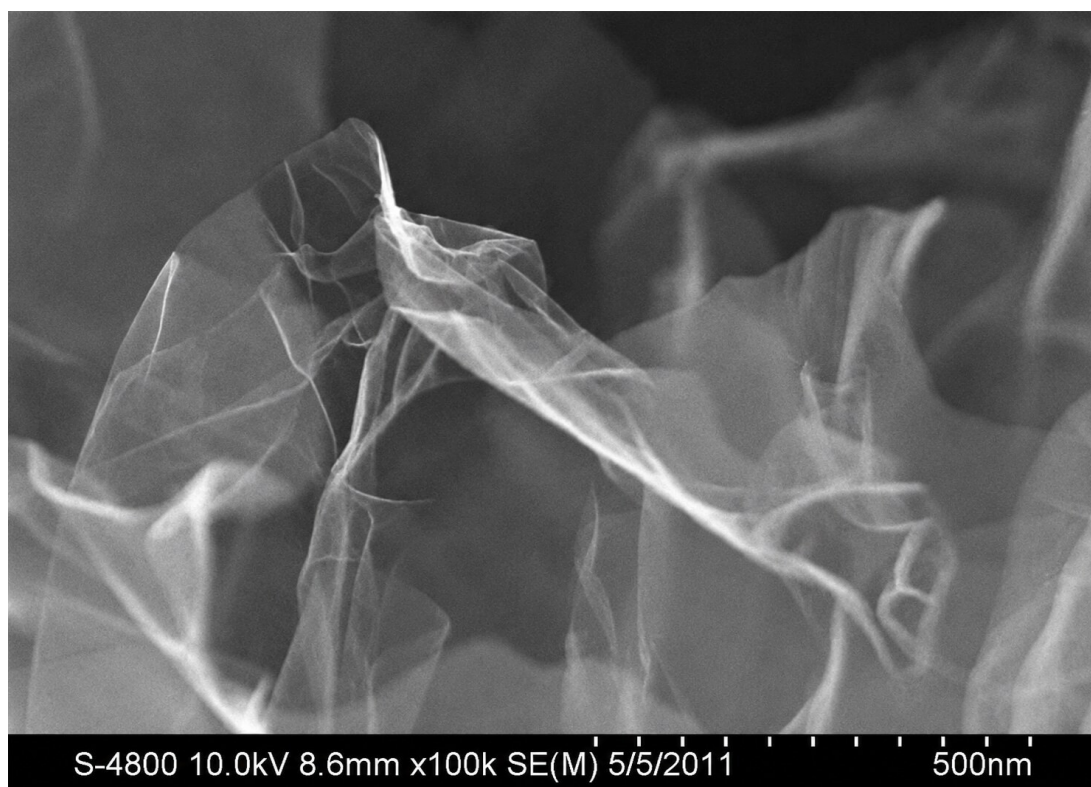
Table 2 — Single Layer Graphene Dispersion in DI Water

Single Layer Graphene Dispersion in DI Water	
Concentration (mg/mL)	1
Flake Diameter (μm)	0.4–5.0
Thickness (nm)	0.6–1.2
DI Water (wt%)	99.9
Dispersant (wt%)	0.1

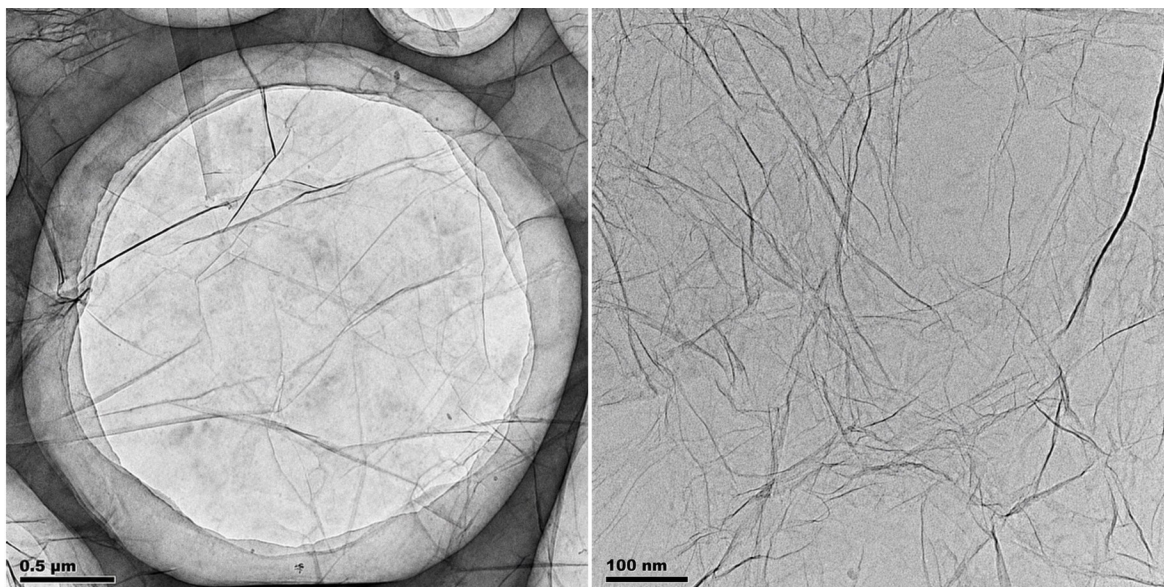
Note: Please ultrasonicate the single layer graphene dispersion before use. Specifications are typical values; confirm lot details at the time of quotation.

SECTION III

Characterization



SEM image of ACS Material's Single Layer Graphene



TEM images of ACS Material's Single Layer Graphene (1) and (2)

SECTION IV

Dispersion Guidelines

ACS Material single layer graphene has no functional groups on the surface, and the powder can be dispersed in water or ethanol with a dispersion aid. Two dispersion aids have been proven useful: sodium dodecylbenzene sulfonate (SDBS) and sodium dodecyl sulfate (SDS).

Add the dispersant to water, then add single layer graphene with the use of an ultrasonic mixer. The addition rate of single layer graphene should be carefully controlled until the desired concentration is achieved. Experiments are needed to determine the appropriate quantity of dispersant in a given system; in our experience with water, 10 mg/mL of dispersant is preferred, and the sonication time should be 15+ minutes. If some settling is noticed — assuming the dispersion has not been over-concentrated — the graphene can be redispersed with the aid of sonication. The maximum concentration of single layer graphene in water is about 0.1 mg/mL with SDBS as dispersant, or 100 mg/L.

Elemental note: single layer graphene contains a small amount of sulfur. Sulfuric acid is necessary for intercalation during the initial treatment, and sulfur cannot be completely removed in the final product.

SECTION V

Applications

Metal-ion-free single layer graphene can be widely applied in battery slurry as a conductive agent to improve high-rate charge-discharge capacity. Typical application fields include:

- **Battery slurries** — conductive components for lithium-ion and nickel-hydrogen batteries
- **Supercapacitors** — conductive reagents for supercapacitor electrodes
- **Catalysis** — catalysts and catalyst supports
- **Energy & solar** — lead-acid cells, solar energy, and solar cells
- **Semiconductors** — graphene chips and the semiconductor industry
- **Conductive films** — conductive graphene films
- **Computer memory** — graphene computer memory
- **Biomaterials**
- **Transparent coatings** — transparent conductive coatings

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