Graphite vs. Graphene:
From Common Carbon to Cutting-Edge Material

Graphite and graphene are both forms of carbon, but they differ dramatically in structure, scale, and performance. Graphite is a naturally occurring mineral composed of up to millions of stacked layers of carbon atoms arranged in a hexagonal pattern. Graphene, on the other hand, is a single atomic layer of carbon - a fundamental building block of graphite - with exceptional properties that emerge at the nanoscale. Graphene nanoplatelets are a product similar to graphene with more layers, 10-200 layers of graphite.

Graphite is naturally occurring and relatively easy to mine; graphene nanoplatelets typically need to be synthesized or exfoliated. Graphene is a building block of graphite: If you peel off separate atomic layers from graphite, you get graphene.

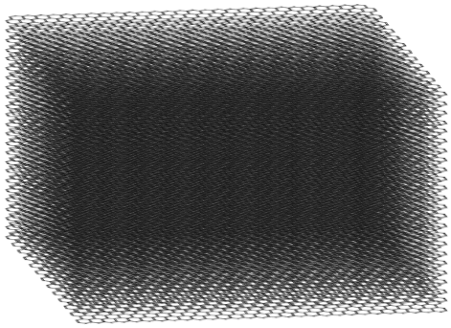
NeoGraf's Graf+® graphite powders and Graf-X® graphene nanoplatelet materials deliver trusted quality and performance that power next-gen technologies in electronics, energy, and coatings.

Comparison of Graf+® Graphite Powders vs. Graf-X® Graphene Nanoplatelets

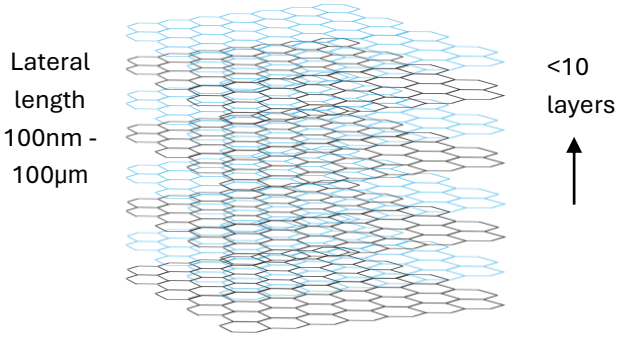
Property	Graf+® Graphite Powders	Graf-X® Graphene Nanoplatelets
Layers	Many layers of carbon atoms	<10 to <200 graphite layers
Arrangement	Hexagonal, stacked in 3D (like a book)	2D hexagonal honeycomb lattice
Bonding	Weak forces between layers (van der Waals)	Strong covalent bonds within one layer

Graphene nanoplatelets stand out as a promising material in modern materials science due to its unique combination of strength, flexibility, and conductivity. While graphite is well-known for its good electrical and thermal performance, graphene surpasses it in nearly every metric. It is 200 times stronger than steel by weight, almost completely transparent, and conducts electricity and heat better than any other material known. Because graphene nanoplatelets are <10 to <200 graphite layers thick, it also enables the development of ultra-thin, high-performance coatings, sensors, and energy storage systems.

Graf+® Graphite Powder



Graf-X® Graphene Nanoplatelets

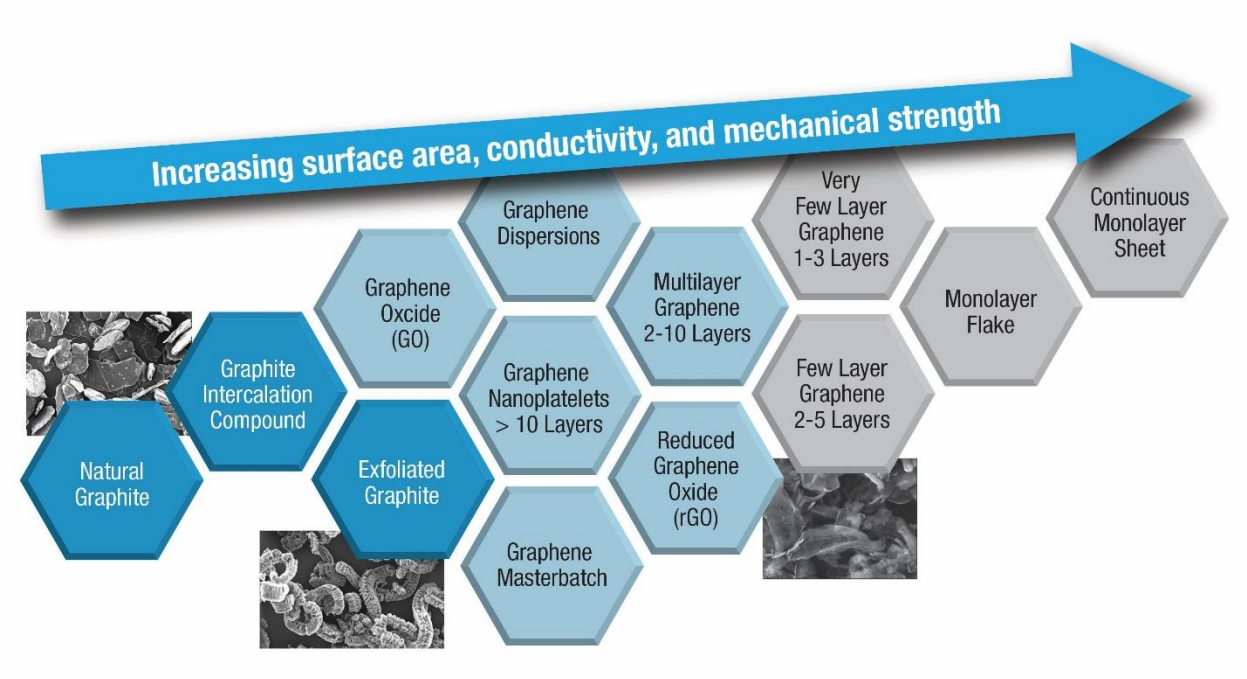


Graf-X® Graphite/Graphene Nanoplatelet Spectrum

The illustration below shows the progression from natural graphite, through graphite powder to advanced graphene materials, highlighting changes in surface area, conductivity, and mechanical strength at each stage.

Starting with natural graphite, the evolution moves through intermediate forms like graphite intercalation compounds and exfoliated graphite, then to graphene nanoplatelets. As the number of layers decreases, materials like multilayer, few-layer, and monolayer graphene offer significantly enhanced performance. The spectrum ends with continuous monolayer graphene. NeoGraf's Graf+ graphite powders and Graf-X graphene nanoplatelet products include natural graphite and expanded graphite powders, graphite nanoplatelets (>10 layers) and multilayer graphene (2-10 layers).

The Evolution of Graphite to Advanced Graphene Materials



Choosing the right form of graphite depends on the application's specific needs for conductivity, strength, and surface area. The following charts outline general recommendations for a variety of applications.

Applications for Graf+® Graphite Powders and Graf-X® Graphene Nanoplatelets Graphene

Application: Coatings

Property	Graf+® Graphite Powders	Graf-X® Graphene Nanoplatelets
Function	Used as a lubricating, anti-corrosive, or conductive filler in coatings	Used in moisture- and gas-barrier coatings or anticorrosive thin films on metals, glass or cement
Electrical Conductivity	good for anti-static applications	Ultra-high electrical/thermal conductivity enables smart coatings (de-icing, sensing, etc)
Pros	cost effective, scalable, chemically stable	Extremely thin, enhances barrier properties, mechanical strength, conductivity
Cons	Lower performance in barrier and strength properties	Expensive, challenging to disperse uniformly
Use Examples	Conductive paints, EMI shielding, anti-static coatings	Transparent conductive films, anti-corrosion nano-coatings, next-gen flexible electronics

Application: Electrical and Thermal Conductivity and Thermal Protection

Property	Graf+® Graphite Powders	Graf-X® Graphene Nanoplatelets
Electrical Conductivity	~10^4–10^5 S/m (bulk, in-plane)	~10^6 S/m (monolayer, CVD)
Thermal Conductivity	~100–2,000 W/mK (bulk); up to ~4,300 W/mK (special forms, in-plane)	~3,000–5,300 W/mK (monolayer, in-plane)
Thermal Protection	used in ablative materials (heat shields, firewalls)	enhances thermal barrier coatings, lightweight, low smoke
Pros	Effective at moderate cost, widely used, easy to process in bulk	Superior conductivity, enhances flame retardancy with thinner layers, lightweight
Cons	Needs larger loadings for effectiveness, lower conductivity than graphene	Expensive, can be difficult to disperse in polymers, limited production scale
Use Examples	Insulation foams, wires, coatings in construction, electrodes	Fire-retardant films, advanced composites, lightweight aerospace/fire safety materials, electronics

Application: Insulation Board (Grey EPS and XPS)

Property	Graf+® Graphite Powders	Graf-X® Graphene Nanoplatelets
Thermal Conductivity	Moderate enhancement; requires higher loadings (10–20 wt%)	High thermal conductivity at low loadings (1–5 wt%); efficient heat dissipation
Pros	Cost-effective, Readily available, Simple to process	Superior strength and thermal performance, Enhances barrier properties, Requires lower filler loadings
Cons	May reduce flexibility, Requires high filler content, Less uniform dispersion	Higher material cost, Requires optimized dispersion and processing, Emerging supply chain
Use Examples	Low-cost thermal insulation boards	High-performance polystyrene boards for electronics packaging

NeoGraf Solutions: Pioneering Graphite and Graphene Innovations

NeoGraf Solutions is a global manufacturer at the forefront of graphite and graphene technology, turning potential into real-world performance with our engineered carbon materials. Graf+ graphite powders offer enhanced conductivity, thermal stability, and flame resistance, making them ideal for use in coatings, foams, and battery additives. For applications that demand even greater performance, Graf-X graphene nanoplatelets provide next-generation solutions by improving mechanical strength, thermal management, and electrical conductivity at low loading levels.

Backed by decades of experience in carbon science, NeoGraf Solutions' advanced materials are helping industries bridge the gap between traditional performance and cutting-edge innovation.

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