NEOGRAF™ SOLUTIONS

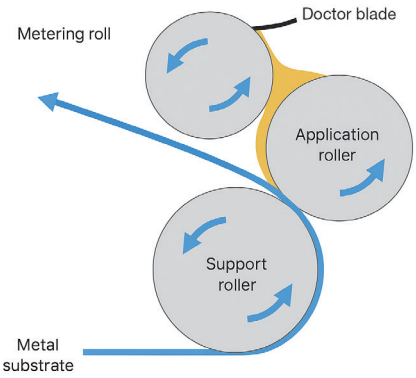
Graf+® | Graf-X™

Graf+® Graphite Powders and Graf-X™ Graphene Nanoplatelets Unlock Next-Level Conductive Coatings

Optimizing Conductivity with Precision-Engineered Graphite

Coatings manufacturers are under pressure to improve electrical conductivity without compromising film integrity or overloading formulations. NeoGraf partners with formulators to engineer graphite solutions optimized for coatings - fine-tuning particle size, morphology, purity, and surface properties. NeoGraf graphite materials integrate seamlessly with hybrid systems, including carbon black, to achieve targeted conductivity with minimal additive loading and maximum performance.

Roll to Roll Coating



Liquid Coating

Key Features of Graf+® Graphite Powders and Graf-X™ Graphene Nanoplatelets

- **Enhanced Conductivity:** Achieves electrical and thermal conductivity in typically insulating materials
- **Low Percolation Threshold:** Small additions can significantly alter material properties
- **Barrier Property Improvement:** Reduced water absorption and gas permeation
- **Versatile Application:** Compatible with a wide range of polymeric systems
- **Substrate Protection:** Provides additional durability and chemical resistance
- **Cost-Effective:** Enables substitution of costly substrates with more economical solutions

Applications

- Automotive and Electronics
- Adhesives and Waxes/ Greases
- Coatings:
  Epoxy | Silicone | Acrylates | Plastisol | Elastomers | Polyurethane | Bitumen

Graf+® Graphite Powders

Graphite's unique layered structure makes it well-suited for creating conductive pathways in polymer coatings. By carefully adjusting particle size, shape (aspect ratio), and surface characteristics, you can fine tune both electrical conductivity and processing performance. High aspect ratio flakes - like those used in Graf+ products - are especially effective at delivering strong conductivity while remaining compatible with a wide range of polymer systems. In contrast, smaller particles disperse more easily and process more smoothly but typically require higher loadings to reach the percolation threshold.

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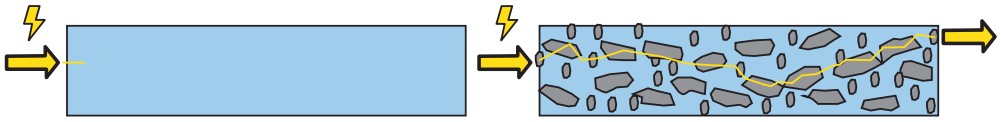
Graf+® Percolation Threshold

The electrical percolation threshold is influenced by several key factors. Fillers with higher aspect ratios and better alignment help lower this threshold, allowing for improved conductivity at lower loading levels. Processing techniques - such as slot die extrusion, spray coating, dip coating, and roll coating - are critical for achieving proper filler dispersion and orientation to maximize conductivity.

The illustration below demonstrates the difference between a neat polymer (left) and a polymer filled with a combination for Graf-X nanoplatelets and a Graf+ powder (right). The path of electrons percolating through the polymer is demonstrated in yellow.



No percolation in Neat resin

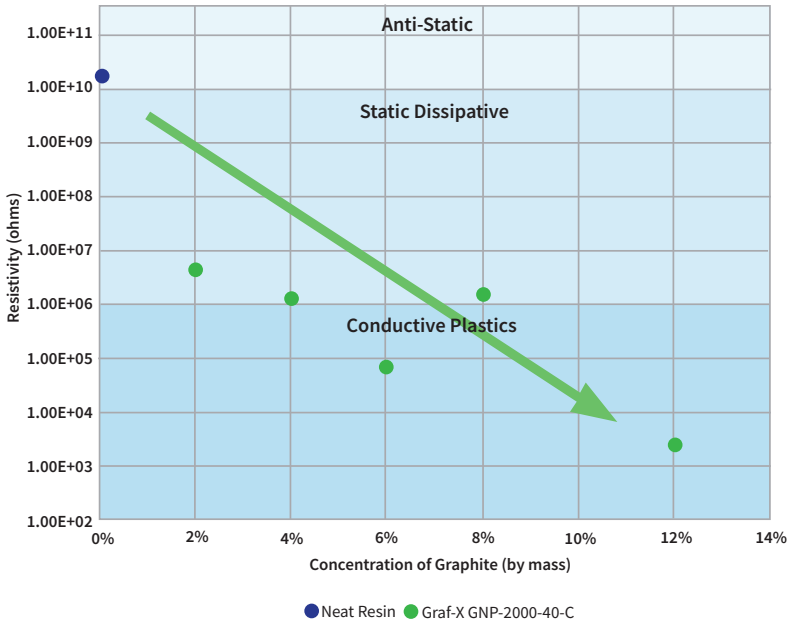
Percolation Through Graf+ 2 different grades

Graf-X™ Graphene Nanoplatelets

For applications requiring ultra-low loadings, Graf-X™ graphene nanoplatelets (GNPs) provide exceptional electrical conductivity. These materials, consisting of 10-100s of graphene layers, achieve percolation thresholds at just 2-15 weight % loading, depending on the polymer and processing method.

A specific example of the electrical conductivity enhancement can be seen through the addition of Graf-X GNP-2000-40-C at increasing loading levels in an epoxy coating cast as thin film. The films were measured for surface resistance. The neat resin is non-conductive while the 2% - 4% loaded systems are static dissipative and the 6%-12% loaded materials can be considered conductive. The colored background shows the typically identified resistance levels for the described properties from anti-static to static dissipative to conductive plastics.

Resistivity vs Loading Level GNP Materials



Commitment to Excellence

Graf+ graphite powders and Graf-X graphene nanoplatelets are produced in North America and meet or exceed all environmental and quality standards in a sustainable manner.

✓ ISO 9001:2015 ✓ ISO 14001:2015 ✓RoHS Compliant ✓ Conflict-Free Minerals

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