HOMMAK®

Graphene Processing & Dispersion

with HOMMAK High-Pressure Homogenizers

Turning "black fluff" into controlled, high-performance dispersions—at scale

Graphene is extraordinary on paper. In real processing, it's demanding. It wants to float, clump, and form stubborn agglomerates that refuse to wet out. If dispersion isn't controlled, performance isn't controlled—conductivity, viscosity, strength, barrier properties, and final product consistency all drift.

HOMMAK High-Pressure Homogenizers (HPH) are engineered to apply repeatable, scalable dispersion energy using intense hydrodynamic forces—shear, turbulence, impact, and cavitation effects—to deagglomerate, stabilize, and refine graphene structures in liquid systems.

Where Graphene Is Used

Graphene and graphene derivatives such as graphene nanoplatelets (GNP), graphene oxide (GO), and reduced graphene oxide (rGO) are used wherever manufacturers want higher performance with lower material loading.

Key Industries

Energy Storage
batteries, conductive additives, supercapacitors

Composites & Plastics
mechanical reinforcement, conductivity, thermal pathways

Water & Environmental Technologies
membranes, adsorption media, advanced filtration

Coatings & Paints
anti-corrosion systems, barrier coatings, conductive coatings

Electronics & Printed Technology
conductive inks, EMI shielding, flexible electronics

Common Application Formats

- Aqueous dispersions (often stabilized with surfactants or polymers)
- Solvent-based dispersions for inks and coatings
- Resin and polymer masterbatches
- Slurries for electrodes and functional coatings

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The Reality: Mixing Graphene Isn't "Just Mixing"

Graphene introduces challenges that conventional mixers struggle to solve consistently.

Wetting and Floaters

Many graphenes are hydrophobic and resist wetting, floating on the liquid surface and forming dry clusters.

Agglomeration

Graphene particles strongly attract each other and form stacked clusters that survive ordinary agitation. These agglomerates cause:

- inconsistent electrical conductivity
- unstable or drifting viscosity
- nozzle clogging in printing and spraying
- weak points in composites and coatings

Shear Control Matters

Too little energy leaves agglomerates intact. Too much uncontrolled energy increases temperature, destabilizes formulations, and can damage binders or additives.

Batch-to-batch Variability

Even with the same formulation, uncontrolled dispersion leads to different results. Graphene is unforgiving when process energy is inconsistent.

Scale-up Limitations

Methods that work in a beaker—especially ultrasonication—often fail at production scale. High-pressure homogenization is widely adopted because it scales predictably.

A Practical Graphene Dispersion Workflow

1 Pre-wet and Premix

Liquid phase is charged first, followed by dispersants or surfactants if required. Graphene is added slowly to avoid dry clumps.

2 Conditioning and Circulation

Low-shear circulation allows full wetting and uniform feed into the homogenizer.

3 High-pressure Homogenization

Material passes through the homogenizing valve at controlled pressure and flow. Multiple passes may be used to reach the target dispersion level.

4 Quality Control and Standardization

Viscosity, conductivity, stability, and appearance are checked to confirm dispersion consistency.

5 Downstream Processing

The dispersion is ready for coating, printing, compounding, electrode production, or filling.

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Why High-Pressure Homogenization Works for Graphene

Inside a high-pressure homogenizer, liquid is forced through a precisely engineered geometry, creating a powerful combination of:

- extreme shear gradients
- intense turbulence
- rapid velocity changes and impact forces
- controlled cavitation effects

For graphene dispersions, this translates into:

- effective deagglomeration of stacked particles
- improved dispersion stability over time
- enhanced functional performance at equal or lower graphene loading
- repeatable results driven by defined process parameters

Unlike “mixing harder,” homogenization delivers controlled dispersion energy rather than guesswork.

The HOMMAK Advantage

HOMMAK homogenizers are designed to support R&D, pilot, and full-scale production, allowing manufacturers to develop a dispersion recipe once and scale it confidently.

Key benefits for graphene processing

Scalable Process Control

Pressure, flow rate, and number of passes are precisely controlled to achieve consistent dispersion quality.

High-Pressure Capability

HOMMAK systems are capable of operating at pressures suitable for even the most stubborn nanomaterial agglomerates.

Consistency Across Batches

Repeatable dispersion energy delivers reliable conductivity, viscosity, and stability—batch after batch.

Reduced Reliance on Operator Technique

Process outcomes depend on defined parameters, not mixing time guesswork or manual intervention.

A Bridge from Lab to Production

HOMMAK systems replace small-scale sonication with a production-ready technology that is easier to validate and industrialize.

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Graphene Applications Where HOMMAK Excels

Conductive Inks and Coatings
Uniform dispersion improves conductivity, reduces clogging risk, and stabilizes rheology for printing and coating operations.

Polymer and Composite Systems
Uniform graphene distribution improves mechanical performance and reduces weak-point failures.

Battery and Energy Storage Slurries
Better dispersion improves conductive network formation and reduces defects in coated electrode layers.

Functional Fluids and Filtration Materials
Stable dispersions improve repeatability in membranes, coatings, and adsorption systems.

What Customers Are Really Solving

This technology resonates most with manufacturers who are saying:

- “Our dispersions settle or drift.”
- “Conductivity and viscosity aren’t consistent.”
- “Our lab method doesn’t scale.”
- “We want lower graphene loading without losing performance.”
- “We need a controllable, validated manufacturing process.”

High-pressure homogenization directly addresses all of these challenges.

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