APPLICATION SUMMARY:

Graphite, a highly conductive crystalline form of carbon, is used in a wide range of products, from batteries, heat sinks and solar cells to coatings, lubricants and composites. Its building block, the one atom-thick graphene, is pushing the boundaries of what fuel cells, ultracapacitors, touch screens, biosensors and other advanced products can do.

This bulletin discusses two proven techniques for dispersing graphite powders, flakes or nanoplatelets into water or a low viscosity non-aqueous solvent. Apart from the type of mixer used, solvent choice, viscosity, operating temperature, order of addition, dispersing agents as well as other solids and additives present can directly affect dispersion quality. Mixer trials performed under process line conditions are recommended to confirm the best dispersion strategy for a particular formulation.

RECOMMENDED MIXING EQUIPMENT FOR Graphite Dispersions

Ross SLIM Technology and Ultra-High Shear Mixers

The Ross Solids/Liquid Injection Manifold (SLIM) is ideal for fast, high-volume dispersion of graphite into liquid. At the heart of this technology is a ported rotor/stator assembly designed to create a powerful vacuum for drawing powders into a high shear zone without the need for external pumps or eductors. The four-blade rotor of a SLIM Mixer runs at tip speeds in the range of 3,000-4,000 ft/min within a close tolerance fixed stator. This induces high levels of mechanical and hydraulic shear but what truly differentiates the SLIM from other mixing devices is the way it combines solids and liquids sub-surface at precisely the point of intense mixing. Dispersion is virtually instantaneous; floating powders and excessive dusting are also eliminated.

More challenging dispersions, like those involving nano-sized graphite platelets or graphene, benefit from even higher levels of shear than what a single-stage rotor/stator can impart. In these cases, an Ultra-High Shear Mixer may be considered such as the Ross X-Series, a patented inline rotor/stator engineered to run at tip speeds over 11,000 ft/min and featuring concentric rows of intermeshing teeth. Solids are first wetted out and pre-mixed into the liquid vehicle. This rough dispersion is then fed to the X-Series, entering at the center and moving outward through channels in the rotor/stator teeth. The extremely close tolerance between adjacent surfaces of the rotor and stator is adjustable for fine-tuning shear level. Unlike other high-intensity dispersion methods like sonication, wet milling and high-pressure homogenization, the X-Series is capable of handling large product volumes at high throughput rates.
The Ross SLIM is proven technology for fast and efficient dispersion of many other solids including:

- Alginates
- Alumina
- Bentonite Clay
- Boric Acid
- Calcium Carbonate
- Carbomers
- Carbon Black
- Carrageenan
- Citric Acid
- CMC
- Dye Powders
- Ground Rubber
- Guar
- Gum Arabic
- Pectin
- Rosin Ester Resin
- Starch
- Sugar
- Talc
- Titanium Dioxide
- Whey
- Xanthan Gum

For more information on the Ross SLIM Technology

Visit www.highshearmixers.com or click here to download a brochure.

**Processing advantages of the SLIM Technology**

- **Simple and straightforward operation.** Just turn on the mixer and start inducting powders. No eductors or vacuum pumps to deal with.

- **Shorter cycle times.** SLIM users switching from conventional mixers and stirrers reduce their overall cycle time often by as much as 80% or more.

- **Higher quality dispersions lead to reduced milling.** When used upstream of a milling operation, the SLIM Mixer produces high quality dispersions that require less passes through the mill and do not cause clogging. Better pre-mixing through the SLIM therefore improves milling performance and throughput.

- **Flexibility.** The SLIM technology is available in both batch and inline designs, making it simple to retrofit into most existing processes. Installed on a mobile cart, the Inline SLIM can serve virtually any size vessel located anywhere in the plant.

- **Easier material handling and improved operator safety.** Solids are weighed and manually charged into the SLIM hopper at floor level or delivered via automatic feeding devices. Operators no longer need to climb up a mezzanine carrying heavy bags of powder for addition into an open mixing tank.