Ultra-high shear mixing: an alternative to three roll milling

Three roll mills, a classic technology

Traditional three roll milling remains to be one of the best methods for preparing very fine particle dispersions in paints, inks, cosmetics, ointments, dental composites and other viscous materials. This classic technology utilizes three horizontally positioned rolls rotating in opposite directions and at different speeds. The product moves from one roll to another by adhesion and the shear forces between adjacent rolls generate the dispersion.

The main shortcoming of three roll mills is their inherently low throughput. Increasing the distance between the rolls improves production rate but it also reduces the amount of shear which can result in a poor dispersion quality. In addition, three roll mills require a skilled technician to safely operate and properly maintain the device. For these reasons, any potential alternative to three roll milling is always a welcome development. Recent advances in rotor/stator technology, for example, offer a number of viable replacements to traditional three roll mills that promise increased throughput and safer operation.
Evaluate an ultra-high shear mixer for your process

The Ross X-Series, QuadSlot and MegaShear inline ultra-high shear mixers consist of special rotor/stator generators operating at tip speeds over 11,000 ft/min. These machines offer a more cost-effective way of delivering very fine dispersions and emulsions that are currently done on conventional three roll mills.

The high tip speeds and complex, turbulent mixing patterns generated within the rotor/stator assembly enable these mixers to impart extremely high levels of hydraulic shear without sacrificing throughput. Particle size reduction down to submicron levels is typical. However, not all three roll mill applications can be transferred to an ultra-high shear mixer. Do perform a mixer evaluation to confirm if your particular formulation is a suitable candidate as the benefits of ultra-high shear mixing are substantial: higher production rates, reduced processing costs and easier maintenance, to name a few. Mixing parameters are easily replicated using electronic variable speed controls while the mixer operation itself is not nearly as labor intensive as in a three roll milling process. Just as importantly, the operator is not exposed to any rotating or moving parts.

Being an inline device, the ultra-high shear mixer can mix raw materials and pump the mixture directly to downstream equipment. Hygienic models designed to be cleaned and sanitized in place are available for sensitive applications.

Sample Application: Silicone Gels

A major producer of silicone compounds is using a Ross MegaShear Ultra-High Shear Mixer for processing their silicone gels. Previously, it took two passes through their three roll mill in order to completely disperse silicone polymers into a silicone or hydrocarbon solvent. Simulation trials at the Ross Test & Development Center confirmed that the MegaShear can achieve the same end results in a single pass – the powerful shearing action of the rotor/stator transforms the crumbly and coarse gelatinous starting material into a very smooth gel.

The MegaShear unit supplied to this company is equipped with a 20HP inverter-duty motor, double mechanical seal, operator control panel and a mixer bench mounted on wheels for portability. Several formulations are being processed in this mixer. The finished products are silicone greases and mold-making materials supplied to the healthcare, cosmetics, electronics, automotive and aerospace industries for a variety of uses and applications.