

## TECHNOLOGY BRIEF:

New ultra-high shear mixers offer improved performance and efficiency over traditional colloid mills. Advantages include higher throughput, greater particle size reduction, easier cleaning and lower capital cost.

# Upgrade your colloid milling operation



## Use and operation of colloid mills

For years, colloid mills have filled the need of mixing applications that required greater shear than what traditional rotor/stator mixers could provide but for which high pressure homogenizers were overkill, both in terms of shear intensity and equipment cost.

In a colloid mill, the mixing action imparted to the process fluid is based on hydraulic shear produced between two cone-shaped discs, one of which is stationary while the other rotates at a high velocity. Tip speeds in the range of 4,000 to 7,000 ft/min are typical. Shear level and flow rate are controlled by varying the clearance between the two discs. Temperature rise is mitigated by a cooling jacket around the stator. In many colloid mill applications, effective mixing relies on adequate particle or droplet size reduction without overheating the product or destroying the integrity of the raw materials.

However, colloid mills also suffer a few disadvantages. The most common issues associated with colloid mills are low throughput and long cycle times due to cleaning. In some cases, a unit can be cleaned by flushing with water. Certain areas of the rotor/stator assembly retain some of this water and often the mill must be dismantled in order to clean and sanitize completely. In addition, most models require auxiliary pumping equipment to feed process fluid into the mill and/or transfer the milled product downstream.

## Ross Inline Ultra-High Shear Mixers



### X-Series US Patent No. 5,632,596

The X-Series head consists of concentric rows of intermeshing teeth. Product enters at the center and moves 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 levels and flow rates.



### QuadSlot

The QuadSlot mixing head is a multi-stage rotor/stator with a fixed clearance. It imparts very high shear levels to process fluids and produces even higher pumping rates than an X-Series set.



### MegaShear US Patent No. 6,241,472

The MegaShear is the most aggressive rotor/stator in terms of shear and throughput. High velocity pumping vanes force the product into semi-cylindrical grooves where it splits into different streams and collide at high frequency before exiting the mix chamber.

## Advanced high speed mixing

Recent developments in rotor/stator technology present a number of viable alternatives to wet milling. Called “ultra-high shear mixers”, these new devices deliver more vigorous mixing, greater size reduction and higher throughput compared to conventional colloid mills. In certain applications, even formulations that previously warranted a move to expensive high pressure homogenizers can now be successfully produced in ultra-high shear mixers.

## Series 700 Inline Ultra-High Shear Mixers

Ross Series 700 Mixers are inline devices available in three ultra-high shear rotor/stator designs namely X-Series, QuadSlot and MegaShear (see box on left for detailed descriptions of each design). Running at tip speeds over 11,000 fpm, these ultra-high shears generate very high levels of hydraulic shear without degrading the product or sacrificing throughput. Typically, the powerful pumping capacity of these mixers is sufficient for transferring the finished mixture to downstream equipment. Flowrates are considerably higher compared to similarly sized colloid mills.

In addition, Series 700 mixers are easier to clean and sanitize in place. Based on user experiences, the shorter cleaning time equates not only to a faster changeover procedure but also to longer intervals between cleaning cycles, meaning longer production runs. Units can also be customized to accommodate multiple process streams. For example, the process fluid can be gravity-fed or pumped to the main mixer inlet while a minor gas or liquid component is metered into a separate port right before the mix chamber.

## Sample Application: Lithium Greases

Ross X-Series Ultra-High Shear Mixers are in operation at a chemical plant making lithium grease formulations.

Before standardizing on the X-Series, the company was using several colloid mills to keep up with production demand. When they decided to improve and streamline their process, their engineers evaluated a number of equipment including high pressure homogenizers and the X-Series. After extensive testing, the samples made in the X-Series all proved superior compared to batches made in the existing colloid mills and in high pressure homogenizers set at 1,000 psi. The evaluations were based on particle size reduction and viscosity. The process upgrade was also a wise financial move as the new X-Series units cost significantly less than any of the other equipment that were being considered.



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