Run your rotor/stator mixer at maximum speed to optimize particle size reduction.

Typical rotor/stator set: four-blade rotor and interchangeable stator heads.

**High Shear Mixers: Operating Theory**

High shear mixers feature a four-blade rotor running at tip speeds in the range of 3,000-4,000 feet/min within a close tolerance fixed stator. This type of mixing device creates mechanical and hydraulic shear by continuously drawing product components into the rotor and expelling them radially through the openings in the stator.

**Equilibrium Particle Size Distribution**

Running the rotor at a particular tip speed yields a corresponding equilibrium, which can be represented through the size distribution of a dispersion or emulsion. Operating below this tip speed, even over a long duration, could produce a different distribution profile. The maximum speed setting of a high shear mixer therefore provides the optimal mixing results in terms of particle or droplet size reduction (with the exception of shear-sensitive applications). Many are reluctant to run their mixer at maximum speed for fear of overworking the machine. As long as the power draw is within the machine’s range, running at the maximum speed is desirable, as you benefit from the highest tip speed that the mixer can deliver. Well-designed mixers work just as well running continuously at maximum speed as at lower speeds.

Continued on page 2
Running at a higher tip speed vs. running longer

Once an equilibrium size distribution is reached, subsequent passes through a rotor/stator maintaining the same speed give diminishing returns. For applications that still fall short of the desired particle size distribution even at the maximum speed setting of a conventional rotor/stator device, a move to a higher energy mixer design is recommended. Charles Ross & Son Company offers the X-Series, QuadSlot and MegaShear ultra-high shear mixers for products that traditional rotor/stators cannot process adequately.

Ultra-high shear mixers vs. conventional rotor/stators

Ultra-high shear mixers operate at higher tip speeds than conventional rotor/stators, around 11,000–18,000 fpm. The product being mixed is subjected to higher levels of shear and more complex turbulent mixing patterns enabling ultra-high shear mixers to produce smaller particle sizes. In many applications, ultra-high shear mixers effectively replace colloid mills and even deliver higher throughput. Ultra-high shear mixers can also finish certain dispersions and emulsions that previously required expensive high pressure homogenizers.

Comparing size reduction performance

The above graph shows particle size equilibrium curves for a particular oil-in-water emulsion prepared in a conventional high shear mixer and in the X-Series, QuadSlot and MegaShear ultra-high shear mixers. In high shear mixing, equilibrium is reached in a given amount of time, typically within 5-10 passes through the rotor/stator. Beyond this point, additional mixing will only result in wasted effort, energy and wear and tear on the equipment.