Mixing and Matching

The New World Economic Order Presents Contrasting Challenges for Process-Systems Makers

For suppliers of processing equipment and systems for coatings manufacturing, the current Asian industrial revolution has required the formulation of a global strategic view. But even in this era of an Asia Pacific-catalyzed new world economic order, key suppliers know they can't neglect the home turf; they must retain a reading of the pulse of the more mature manufacturing economies of the West.


Cohen

Mixing-equipment manufacturer Charles Ross & Son Company, Hauppauge, NY, offers an intriguing case study of this global view. The company, which traces its beginnings to the 1840s, has clearly staked a claim to the rich industrial lode being tapped in Asia, establishing manufacturing operations at two locations in China.

Back home, meanwhile, Ross has sought to tailor its product offerings to a different manufacturing culture — one that places a premium on efficiency, cost effectiveness and the mounting challenge of making environmentally compliant higher-solids and waterborne products. In defining its response to these challenges, Ross likes to use the term "ultra-high-shear" technology.

Ross's major mixing-equipment introductions in recent years include the "X-Series" mixer, designed to produce sub-micron emulsions and dispersions by means of a close-tolerance, multi-rowed rotor/stator mixer that operates at high speeds. Billed as possibly an even more revolutionary advance is the company's "Solid/Liquid Injection Manifold" technology, or "SLIM," for high-speed powder induction.

Ross Vice President of Technical Services Doug Cohen says the SLIM technology represents a quantum leap forward in processes where the addition of powder materials to liquid streams presents difficult "wet-out" and deagglomeration situations that can often exert serious drag on processing speeds.

In the SLIM system, Cohen says, solids are combined with the liquid flow at the point of maximum mixing intensity. A specially modified rotor/stator generator equipped with a design the company calls "Progressive Spiral Porting" creates a powerful vacuum and draws the powder directly into the high-shear zone, where it is rapidly dispersed into the liquid stream.

Cohen says the simultaneous introduction and mixing of ingredients also allows effective processing of liquids at much higher viscosities than in-line mixing systems that employ an eductor, which adds powder to a liquid stream prior to mixing in the rotor/stator. This high-viscosity capability offers advantages in processing the much higher-solids materials encountered in the increasingly lower-VOC formulations currently being produced by coatings manufacturers.

In a recent conversation with **PCI**, Cohen reviewed the SLIM technology and other high-shear mixing advances that he says represent a response to the processing requirements of coatings manufacturers in the 21st century.

PCI: What are the primary directions being seen in coatings products and what does that mean for manufacturing processes?

Cohen: Compared to solvent-based systems, waterborne systems typically process at higher viscosities or go through viscosity transitions. Therefore the equipment that was for many years dedicated to the production of solvent-based coatings may be totally incapable or inadequate for producing the waterborne variety of those same products.

What types of equipment have evolved in response to these changing requirements?

Cohen: The range of equipment choices has expanded for high-viscosity coatings applications. Double planetary mixers, planetary/disperser hybrid mixers like the PowerMix, and multi-agitator mixers are all now much more widely used because they handle elevated levels of viscosity. What's disappearing are the formulations that can be made on a single-shaft, high-speed disperser alone. As the viscosities go up, that device can't handle the viscosity by itself. So we're supplementing the high-speed disperser with a planetary blade, a three-wing anchor, or helical anchor-type agitator that can turn over a viscous product or viscous phase of a product.

There isn't an appreciable difference in the finished product. The difference is in the transition in viscosity that the product goes through during the manufacturing phase.

Water is not always the best medium in which to disperse or grind pigments, so you're often dispersing or

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grinding them in low-water, high-resin type regimes and then letting them down with additional water to reach the viscosity that you're looking for.

Emulsions are produced through what we sometimes call inversions. An emulsion is typically characterized as an oil in water emulsion or a water in oil emulsion. If you want a water-dispersible product you have to have an oil-in-water emulsion as your finished product. To get to that, you very often have to start out with a water-in-oil emulsion to disperse your pigments or your additives and then let your emulsion invert by adding more water or adding surfactants that favor water as the continuous phase.

Many of those technologies require high-shear mixing to achieve the end result. The extreme case is when the viscosity is so high that you have to go to a multi-shaft or planetary mixer to get through that viscous phase.

What is the state of the art in terms of new mixing technology in this industry?

Cohen: From our perspective, the growth and technology development has been predominantly in ultra-high-shear, in-line designs like our Quad-Slot, X-Series and MegaShear mixers. This is being driven by a focus on eliminating more expensive, high-energy processes like high-pressure homogenization, media milling and three-roll milling. For any product that you can take out of the high-energy milling area and move it into the rotor-stator area, you've just slashed your processing cost dramatically, and increased production.

The other significant growth area is in powder induction technology — the SLIM system. With a high-speed in-line induction system like this one, you're increasing worker safety and minimizing product wet-out times. A system like this allows you to eliminate that familiar scene of an operator dumping a bag of raw ingredients into an open tank, which creates dust and health hazards and dust explosion risks. Wet-out was also extremely slow — which is a cycle-time issue — and agglomerates were also formed, which then had to be dispersed with some other type of device.

With the SLIM, you can get the powders introduced right into the stream of liquid. Then you've solved a wide range of problems that you encounter when you formulate these kinds of products.

For more on PCI's discussion with Doug Cohen, visit www.pcimag.com.