TECHNOLOGY BRIEF:

This bulletin presents some processing techniques for improving the mixing performance of double planetary mixers.

Improve the performance of your double planetary mixer.

Ross Double Planetary Mixers with Rectangular Stirrers (left) and Helical High Viscosity “HV” Blades (right).

Basics of planetary mixing

A double planetary mixer moves material by rotating two identical blades on their own axes as they orbit on a common axis. The blades continuously advance along the periphery of the mix vessel, removing material from the walls and transporting it towards the interior.

The double planetary mixer is most commonly used for mixing viscous pastes and dough-like materials, but it can also prepare dry and wet granulations. When operated as a vacuum mixer/dryer, it can transform pastes or slurries into free-flowing powder form.

Blade movements in a double planetary mixer after 1, 3 and 36 revolutions wherein the blades have contacted virtually the entire batch.

Continued on page 2
Processing techniques to improve mixer performance

The double planetary mixer is a relatively low speed device. It relies on a product’s viscosity to impart shear as the blades move through the batch and push materials against the vessel surfaces and between the blades. While this mixer can operate at viscosities as low as 50,000 cP, it works more efficiently at higher levels when shear is necessary for proper dispersion of product components. As the viscosity of a heavy paste approaches 2 million cP, shear in the batch increases steadily, agglomerates disintegrate and average particle size drops quickly. For this reason, manufacturers often deliberately raise the viscosity of a batch to accelerate dispersion and then let it down to the desired final viscosity at the end of the cycle.

During let-down, it is typically recommended to gradually add the low viscosity liquid through a charge port as the mixer is running. This prevents the viscous batch from forming lumps that slide against each other, lubricated by the let-down fluid. Running at a high blade speed also helps to incorporate the low viscosity component faster.

For applications that require frequent scrape-down due to product climbing up the traditional rectangular stirrers, try helical blades instead. High Viscosity “HV” blades offered on Ross double planetary mixers feature a precisely angled helical contour that pushes batch material forward and downward. The absence of horizontal crossbars allows the agitators to be lifted very easily out of a viscous batch.

Based on user experience, “HV” blades outperform rectangular stirrers in almost all applications and they can handle viscosities as high as 8 million cP. Finger blades are considered for special applications that require mixing of delicate solids and fibers.

Sample Application: Polymer Solutions for Membranes

Ross Double Planetary Mixers are used to dissolve polysulfone pellets in NMP under heat. At the early stages of the mixing cycle, the resin pellets melt into one big mass. The robust design of the HV blades keeps the viscous batch moving and maintains a uniform temperature until all lumps are completely dissolved into the solvent and product viscosity goes down.

The resulting polymer solution is used for the production of membranes utilized in water filtration, wastewater treatment, gas separation, pharmaceutical production, food and beverage processing, and other applications.