High capacity screening of resin powder at -180°F / -82°C
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Among varied techniques to pulverize materials on a toll basis, the Custom Services Group of Solvay Solexis cryogenically grinds and screens plastic resins such as fluoropolymers, nylons, polypropylenes, engineering resins, polyurethanes and polyesters. The grinding processes involve screening at custom sizes, which can place extreme demands on screening equipment, particularly at cryogenic temperatures from -50° to -275°F (-46° to -170°C).

"Sifter screens are more susceptible to breakage under cryogenic conditions due to embrittlement from the cold," says Craig Davis, sales and marketing manager. "It is critical to minimize downtime when this happens because system components can freeze, and material left in the system can get wet."

He continues, "The choice of sifter is crucial to a grinding operation in terms of its ability to keep up with the grinding process at a variety of screen sizes, and its impact on the operation from a maintenance standpoint."

Solvay Solexis found circular vibratory separators easy to clean and maintain, but blinding at sizes finer than 300 microns with powder containing as much as 30-50% of oversized material. To achieve a respectable throughput rate, the separator needs to be large in diameter, which can pose a problem if space is at a premium.

Rectangular gyratory screeners, Solvay Solexis concluded, have adequate screen area to keep pace with grinding operations, but their service in cryogenic operations requires a considerable amount of upkeep due to frame warpage and wear and tear on gaskets and wire cloth. When a problem occurs with a rectangular screener, Davis says it takes at least an hour for an experienced person to remove, comb through, repair, and finally replace 8-12 screens. The long downtime can lead to startup difficulties in a cryogenic operation.

Tough screening problem solved centrifugally

"Centrifugal screeners provide a eliminate compromise because they keep up with grinding processes with the same efficiency as a rectangular screener, but are easy to clean and maintain like circular vibratory screeners," he says. Solvay Solexis uses centrifugal screeners on many of its cryogenic processes.

Centrifugal separators contain a stationary, horizontally-oriented wire cylinder, inside of which are rotating helical paddles that continuously propel and accelerate on-size material through the cylinder walls, ejecting oversize particles through the downstream end of the cylinder into a discharge spout.

Davis found centrifugal screeners to meet his capacity requirements and – due to the action of the rotating paddles, which do not contact the screen – to aid in breaking down of loose agglomerates while reducing the incidence of screen breakage per ton of polymer screened.

Solvay Solexis recently added the "Quick-Clean CENTRI-SIFTER" separator from Kason Corporation. This unit is equipped with three roller bearings located outside of the screening chamber instead of the normal two. The bearings at the motor end of the shaft and on a hinged cover at the discharge end provide the support needed to handle the high speeds and loads of high capacity screening without vibration. When the end cover is hinged open, the
shaft becomes a cantilever supported by the third bearing located between the motor-end bearing and material feed point, allowing the screens and/or paddles to be removed rapidly for replacement or wash-down.

In low temperature application, rapid screen changes not only minimize interruptions, but allow restarting of the frigid unit before the formation of ice can hamper or prevent restarting. As a toll processor, Solvay Solexis also benefits from rapid wash-downs it frequently performs to prevent cross-contamination of custom production runs.

One such application involves milling and screening of a fine, free-flowing, heat-sensitive fluoropolymer powder to 150 microns at 300 lb/hour (136 kg/hour). Chips of the material are pre-chilled in a cryogenic conveyor before being broken down by a cryogenic hammer mill that is cooled using liquid nitrogen to approximately -180°F (-82°C). A flexible screw conveyor transports the granules to a Kason centrifugal screener that scalps particles larger than 150 microns (100 mesh). With each pass, the process generates 50-70% on-size material. Oversized material is reintroduced to the mill for further grinding and a final yield of on-size powder greater than 97%. With the right system parameters, the final powder meets the customer's strict specifications for particle size, bulk density, and moisture.

Solvay Solexis also micronizes, screens and blends resins and other materials at ambient temperatures in conjunction with 15 milling operations, and packages liquids and solids in containers ranging from bulk bags to small sample packs. Products handled include additives for paints, inks, polymers, and nutritional products (nutraceuticals), compounds, adhesives, and specialty resins suited for sintering, composites, and fabric coating applications.