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Ask an Expert

How material feedrate control affects size reduction, mill effectiveness

Q: How does controlling material feedrate influence size reduction and a mill's effectiveness?

Jeffrey A. Klinger, Custom Processing Services, says:

Material feedrate is one of the most important controls that can influence a mill's effectiveness to achieve the desired particle size for various types of size reduction equipment. Feedrate control methods will differ depending on your equipment type.

In a fluidized-bed jet mill, feedrate depends on the material's grindability, as well as the jet mill's classification and airflow settings. For instance, a fluidized-bed jet mill's material bed could be preset to remain at a constant weight of 300 kilograms (within ±30 kilograms or 10 percent) during grinding. As conforming material exits the jet mill and the mill's material bed weight drops to 270 kilograms, PLC monitoring equipment signals the feeder to dispense more raw material into the mill and continue refilling until the mill's material bed weight hits 330 kilograms. Keeping the mill bed at a constant weight during grinding will produce a more uniform particle size distribution.

Feed input to the fluidized-bed jet mill also can be controlled based on power consumption. In this method, PLC monitoring equipment measures the jet mill's internal classifier's power consumption. Based on preset parameters, the PLC signals the feed system on how much material is needed to maintain a constant mill bed weight.

In a flat-style air jet mill, or *pancake mill*, a consistent feedrate ultimately controls the final particle size. As you increase or decrease the feedrate, the mill's centrifugal and drag forces existing within the airstream deliver bigger or smaller particles to the mill's central outlet, thus controlling the overall particle size distribution.

In mechanical grinding equipment, such as a hammermill, a pin disc mill, or a universal mill, the mill motor's horsepower can limit the material feedrate. In some instances, slightly overfeeding or choke-feeding a mechanical mill outfitted with a screen can influence the mill's effectiveness to meet a specific particle size efficiently. Sometimes choke-feeding can result in a finer product than you would otherwise produce in that piece of equipment. Overfeeding also could trip out the motor, result in nonconforming product, accelerate mechanical wear, and cause excessive power use, yet underfeeding or starving the mill won't allow the operator to take advantage of the mill's capacity. Generally, you must stay within the mill's limitations.

When you're simply classifying ultrafine powders for particle separation and not reducing their size, the feedrate is adjusted to meet a specific air-to-product ratio that will control the particle size distribution and overall yield. The capability of ultrafine air classification relies heavily on consistent feedrate control that's monitored using a PLC. Material characteristics such as, density, initial particle size, and the product's overall morphology can influence feedrate control. Consequently, achieving the optimum feedrate setting is essential to obtain the targeted particle size distribution split and overall product yield.

Ultimately, the key when using any external feeding system in particle size reduction is maintaining a consistent material feedrate so you don't overfeed or underfeed. This is critical in achieving your targeted particle size distribution while maximizing output efficiency.

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