A new jet mill design facilitates cleaning, thereby minimizing cross-contamination and increasing product quality and production efficiency.

Contamination-Free Milling

by **Joseph Muscolino,** Product Manager, Sturtevant Inc., Hanover, Mass.

Cross-contamination is always a concern when milling ceramic powders. For highly sensitive applications, even the smallest amount of contamination can cause the finished powder to be rejected, resulting in wasted time and raw materials. However, many jet mills do not adequately address this problem. In jet mills that feature a closed compressed air manifold, the manifold receives the supply of compressed air and distributes it to the grinding chamber through a number of tangential jet nozzles (see Figure 1). Pressure fluctuations that occur within the mill both at startup and shutdown allow material to enter the manifold, but such contamination often only becomes apparent after the mill has been operated. Although the manifold can be cleaned between runs, the cleaning procedure can be difficult to execute and does not ensure that all of the contaminants have been removed. For this reason, closed-manifold jet mills have typically been avoided in high-tech ceramic manufacturing applications.

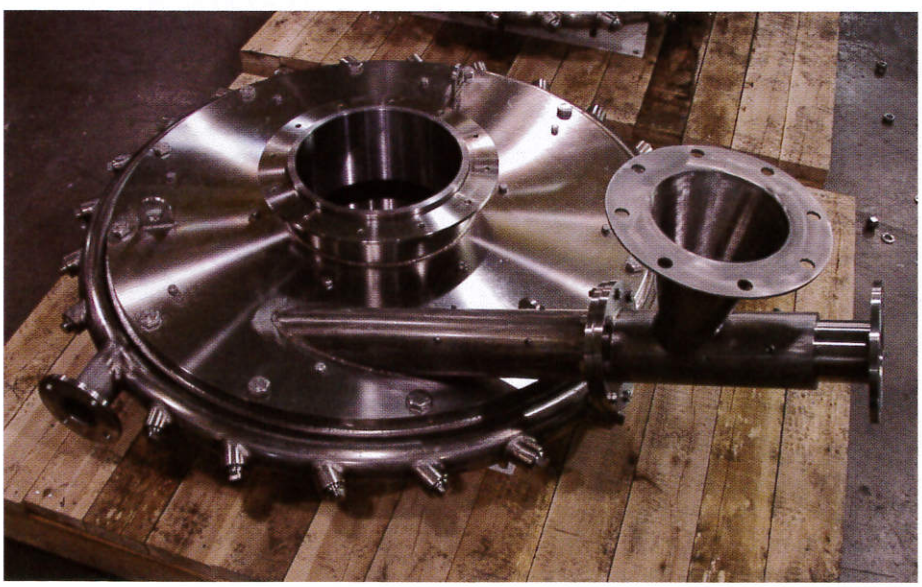


Figure 1. A closed-manifold jet mill.

A new jet mill* has recently been introduced that promises to overcome these problems. Initially developed for the pharmaceutical industry, the mill became so popular that it was soon modified for use in other industries—including ceramic manufacturing. Designed with an open manifold, the mill facilitates cleaning, minimizes cross-contamination, and increases both product quality and production efficiency.

*The Open Manifold Design Micronizer®, supplied by Sturtevant Inc., Hanover, Mass.

Reprinted with permission from the April issue of *Ceramic Industry* magazine.

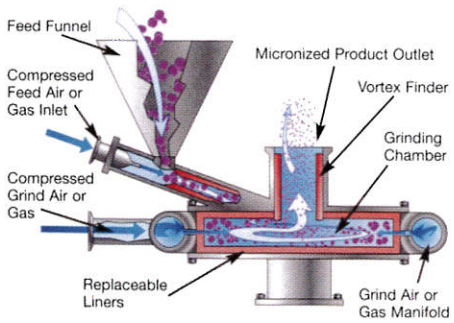


Figure 2. A schematic of the open-manifold jet mill.

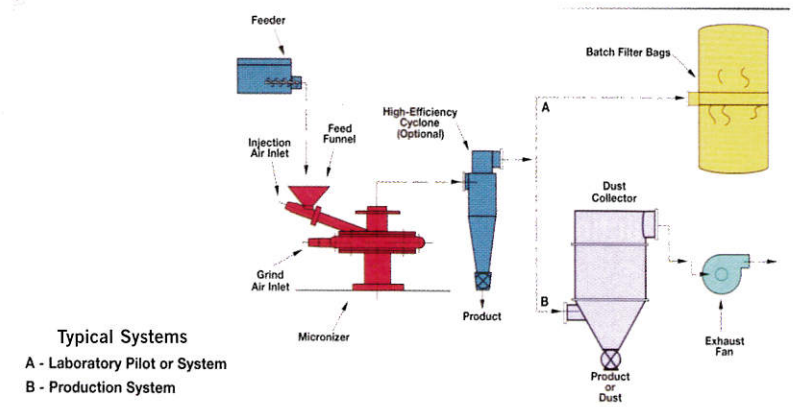


Figure 3. Basic mill components.

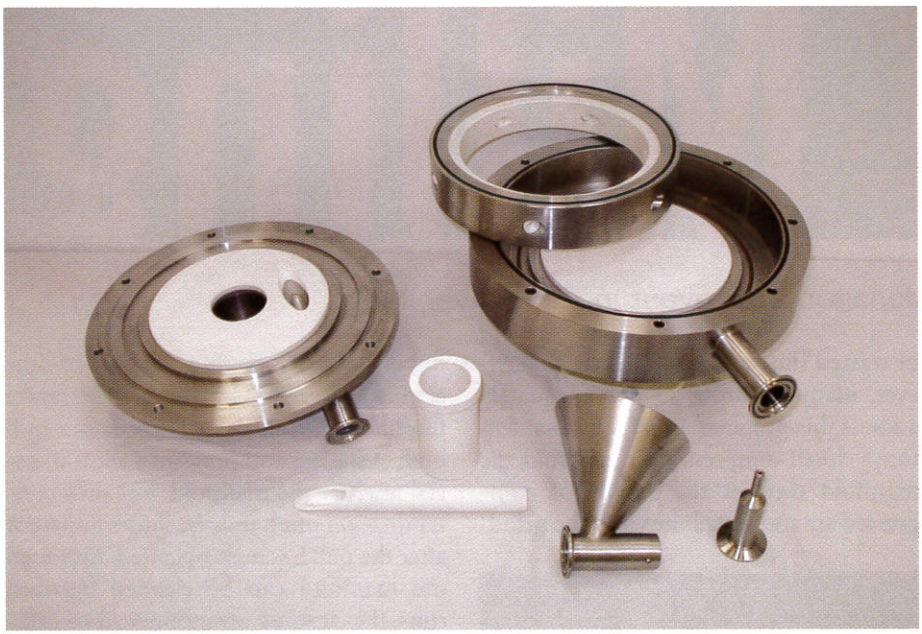


Figure 4. The disassembled plates and rings from an open-manifold jet mill.

Basic Mill Components

The new mill is a spiral jet system with no moving parts (see Figure 2). It is designed to grind and classify powders to micron and sub-micron particle sizes in a single operation using high-pressure compressed air, gas or steam.

As with other mills, a number of basic components are integrated into the system to ensure maximum operating efficiency (see Figure 3). The volumetric screw feeder, shown on the top left side of the figure, accurately meters the feed material into the mill according to a preset program. The material feed rate also controls the fineness of the product by establishing the residence time in the mill. Higher feed rates (and thereby shorter residence times) generate coarser products, while lower feed rates (longer residence times) generate finer products.

Once inside the mill, powders are pulverized through particle-on-particle impact, using centrifugal force and retention time as the classifying functions. One compressed air inlet pneumatically conveys the feed material from the screw feeder into the mill chamber through an eductor, while the other compressed air inlet supplies the grinding energy through a series of tangential grinding jets. Higher grinding pressures produce finer powders, while lower grinding pressures produce coarser powders. The feed pressure usually has little effect on product fineness.

The dust collector uses a fabric filter receiver to recover all of the powders as a finished product.** Filters are selected based on the fineness, stickiness and/or abrasiveness of the powder being processed. The unit is designed to be self-cleaning and features a small source of compressed air that periodically "pulses" the powder off the filter bags or cartridges. Filter bags or cartridges snap securely into the top, ensuring a good seal, and can be changed out with minimal operator contact. (Adequate headroom clearance must be provided near the machine. Bottom bag removal designs that require less headroom can also be used.) A rotary airlock valve is used to protect against air leakage in both the dust collector and optional cyclone.

Since the compressed air in the mill is not enough to convey the material through the entire system, an exhaust fan is used to overcome the static pressure of the dust collector and ductwork. A manual damper (not shown) is used to ensure that the system remains balanced.

**Although the self-cleaning dust collector is an integral part of the mill in most applications, small batch operations can typically recover powders in less expensive loose bags.

An Open Manifold Design

The basic operation of the new jet mill is similar to that of the closed-manifold jet mill; however, the manifold design of the new mill provides a key advantage. Unlike closed compressed air manifolds, which are difficult to remove and provide limited access for cleaning, the open manifold consists of a simple assembly of plates and rings that disassembles in minutes to provide complete accessibility to the internal material grinding chamber and the compressed air chamber (see Figure 4).

Any risk of cross-contamination can be eliminated through a simple cleaning procedure. Additionally, each time the mill is opened, operators have an unobstructed view of both the grinding and air chambers (see Figure 5), which can be crucial for detecting material buildup and liner wear. When maintenance is required, the inner jet ring is simply lifted out for complete access to the grinding jets (see Figures 6 and 7). The liners can also be disassembled and replaced in the plant, rather than being returned to the supplier for repair or replacement, which saves both freight costs and valuable downtime.

High-Quality Grinding

The new mill can be used to successfully grind a number of ceramic powders, including metal oxides (aluminum oxide, zirconium oxide, iron oxide, etc.), ferrites, titanates, nitrides, silicates and carbonates. In most cases, the mill can produce powders in sizes from 1-10 microns, depending on the material's grindability; in some cases, the mill has achieved powders that are as fine as 99% less than 1 micron and 50% less than 0.6 microns.

In conjunction with this efficient grinding performance, the mill also provides the significant benefit of fast, easy cleaning. As a result, manufacturers working with a variety of powders can ensure high-quality, contamination-free grinding with minimal downtime and effort.

For more information about the open-manifold jet mill, contact Sturtevant Inc., 348 Circuit St., Hanover, MA 02339; (800) 992-0209 or (781) 829-6501; fax (781) 829-6515; e-mail info@sturtevantinc.com; or visit www.sturtevantinc.com.

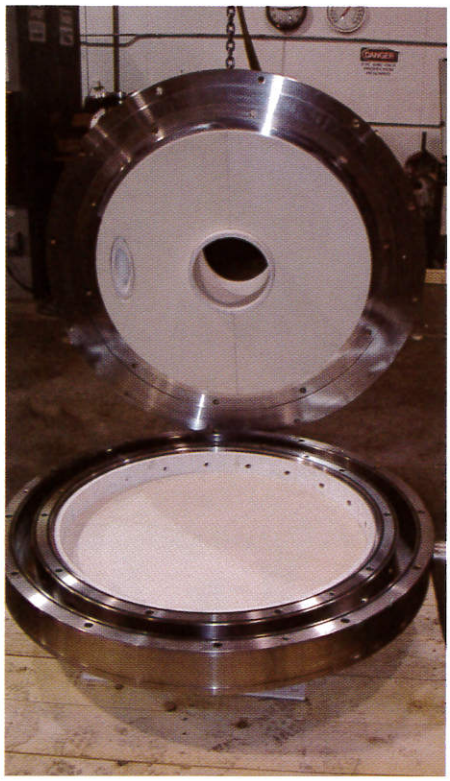


Figure 5. An open-manifold jet mill, open for inspection.

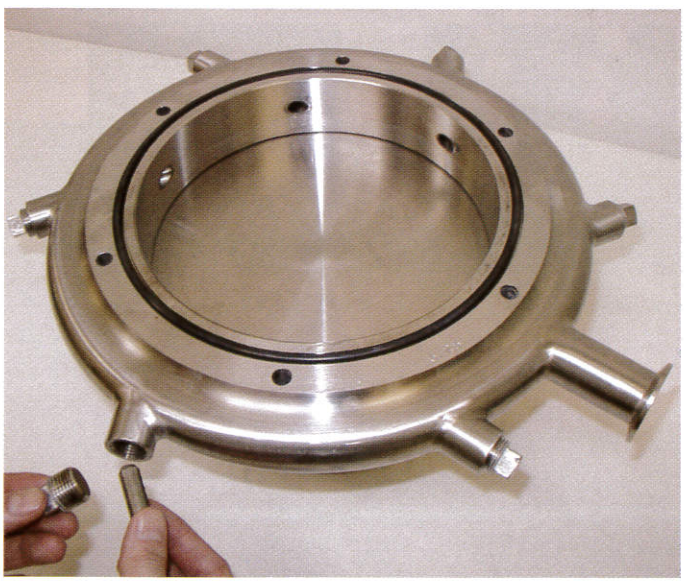


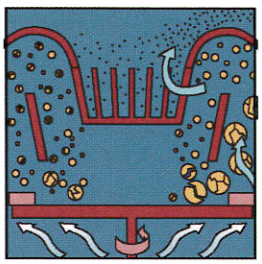
Figure 6. In a closed-manifold jet mill, the jet removal must be done through access ports.

Figure 7. In the open-manifold jet mill, jets are easily removed without access ports.

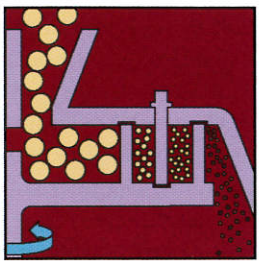
PROVEN PERFORMERS

For most dry material size reduction or separation needs,
Sturtevant's extensive line of products can meet your requirements.

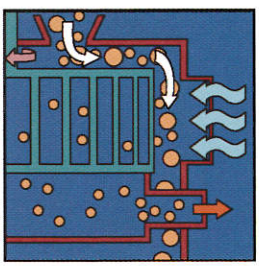
Micronizer®: Jet mills dry particles to sub-micron size; some models USDA-accepted.



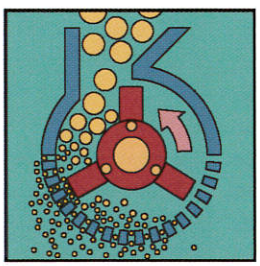
Powderizer®: Air-swept impact mill with integral classifier; grinds to low-micron range with tightest particle size distribution.



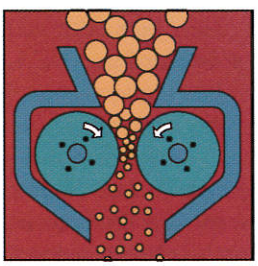
Simpactor®: Centrifugal, pin-type impact mill; reduces low- to medium-density materials to 50-200 mesh.



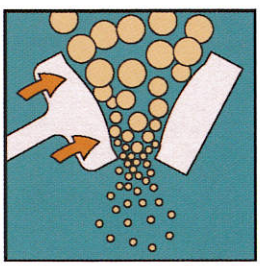
Air Classifiers: Air streams separate fine and coarse particles with mechanical rejector for product quality assurance.



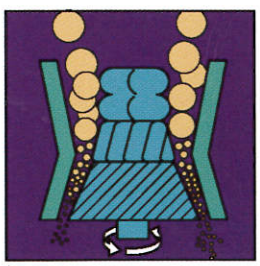
Hammermill: Versatile, perfect for friable materials; easy access for maintenance or inspection.



Roll Crusher: Best-suited for controlled reduction of friable materials; minimal fines.



Jaw Crusher: Ideal for coarse and intermediate crushing; minimal fines production.



Screening Machines: Separates powders into several fractions for multiple products or eliminating dust and oversized particles.

Sample Grinders: Disk type grinder for very fine work at small throughput rates.

STURTEVANT® Inc.

POWDER PROCESSING TECHNOLOGY: THE STURTEVANT SOLUTION.

Sturtevant, Inc.
348 Circuit Street
Hanover, MA 02339

- **PHONE: 781-829-6501**
- **FAX: 781-829-6515**
- **TOLL FREE: 800-992-0209**
- **E-MAIL: sales@sturtevantinc.com**