

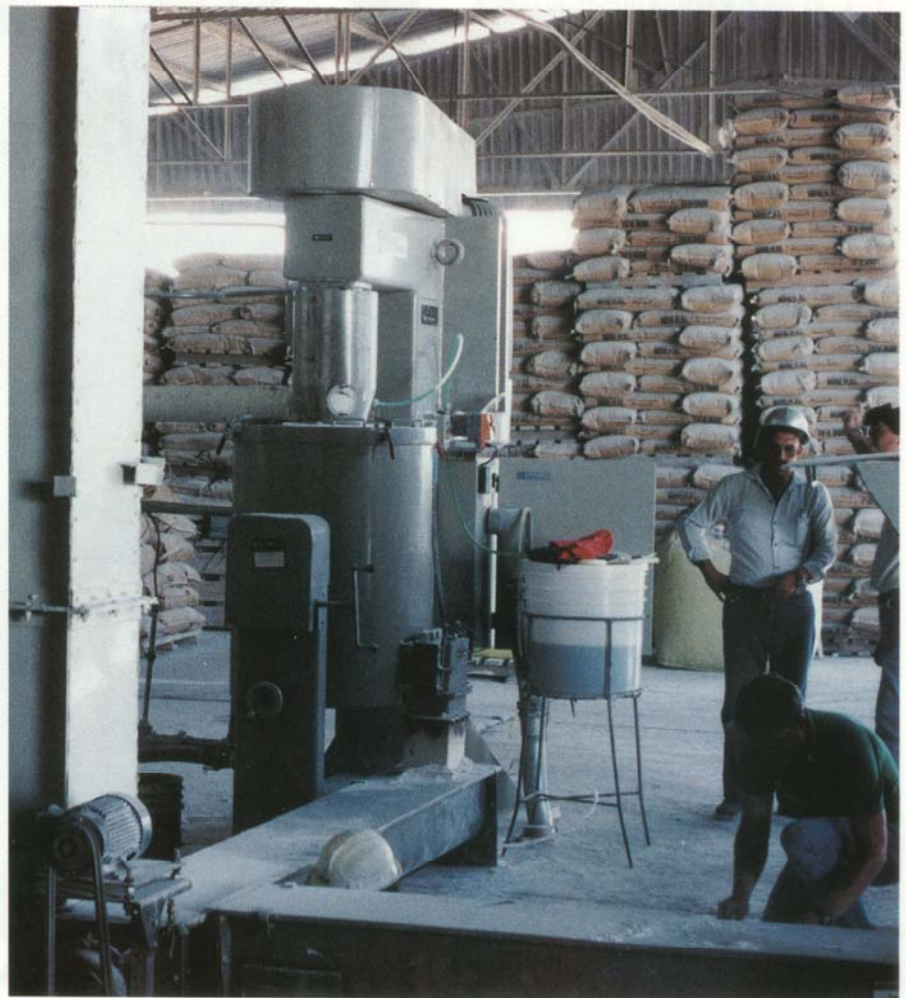
Reprinted from:

Powder and Bulk Engineering

VOLUME 7 NUMBER 12
DECEMBER 1993 \$7.50

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Case history

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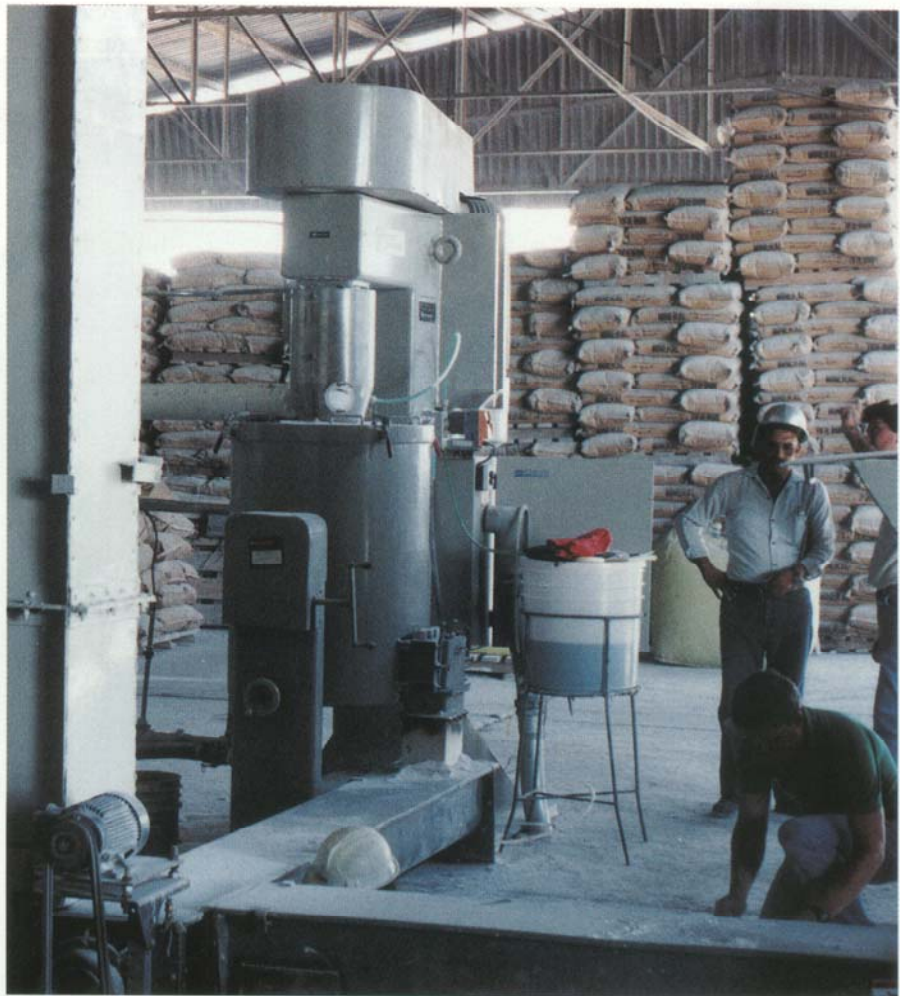
Milwhite, Inc., an industrial and specialty mineral supplier based in Houston, has developed and manufactured products from baryte for more than 60 years. White baryte is a very dense, pure, natural ore used as a high-density filler in paint, coatings, and plastics products. The mineral supplier began finely grinding baryte more than 20 years ago.

The mineral supplier mines baryte in Galeana, Mexico, about 120 miles from its Monterrey, Mexico, plant. During mining, workers drill holes in the baryte 700 feet underground and use dynamite to blast the mineral into chunks up to 1½ feet across. Jackhammers also loosen some baryte. A hoist then raises the mined baryte to ground level.

The baryte is hand separated to divide the denser, pure-white baryte from dark baryte. Jigs and tables classify the material by density. The dark baryte, along with tailings from the white baryte, is transported by truck to a roller mill at the mine site and reduced to 98 percent smaller than 200 mesh. This material is used primarily as drilling mud in oil field applications. The white baryte is finely ground later and used for industrial applications.

Contract grinding increases costs

In the past, the mineral supplier imported white baryte from Mexico, ground the baryte in a roller mill at its Brownsville, Tex., plant, then sent the mineral to contract grinders throughout the US for size reduction to the 2- to 5-micron mean par-



The mineral supplier uses a high-speed stirred ball mill to grind minerals to 2 microns.

ticle size (6½- to 7-Hegman range) required by many of its customers. The contract grinders used air mills or stirred ball mills to grind the baryte.

"The contract grinders typically were very expensive," says Milwhite vice president of operations Mike Hughes. "We got to the point where we were ready to invest in the fine-grinding equipment ourselves to become more cost-efficient." Besides high grinding fees, using contract services required transporting baryte to and from the grinder, increasing overall transportation costs.

Although the contract grinders finished jobs on time and produced uncontaminated products, the mineral supplier could have a large quantity of finely ground baryte in its warehouse. The baryte might take 3 months to sell, and the mineral supplier had already paid the contract grinder, increasing inventory overhead.

Mineral supplier seeks mills

To fine-grind minerals themselves, Milwhite's affiliate in Mexico, Molinos del Norte S.A., invested approximately \$1 million in its Monterrey plant. The investment included fine-grinding equipment for white baryte. In addition, the mineral supplier introduced a new product line — fine-ground calcium carbonate. Calcium carbonate is used primarily for paper coatings and also in paints, rubber, latex forms, putties, caulks, and adhesives. Mexico had been importing the vast majority of its calcium carbonate from the US, so producing the mineral in Mexico reduced transportation costs.

Anticipating the Monterrey plant investment, the mineral supplier assembled an information file and contacted mill manufacturers for more information on several machines that could reduce baryte and calcium carbonate. The mineral supplier considered using air mills but found the machines to be relatively complex

and expensive to operate. The mineral supplier sought grinding equipment that would be simple and easy to maintain with readily available spare parts. The supplier then considered two types of stirred ball mills. Both mills appeared well suited to reducing baryte and calcium carbonate, and the less expensive mill was chosen for further investigation.

The mineral supplier contacted the mill manufacturer's test center to arrange tests and confirm the mill's suitability to fine baryte and calcium carbonate grinding. The mineral supplier then sent samples of both minerals to the test center and attended a day-long test series that confirmed the equipment could mill the minerals to a consistently fine size. As a result, the mineral supplier ordered two mills for the Monterrey plant. One of the Monterrey plant's mills is dedicated to baryte, the other to producing natural, white, dry-ground calcium carbonate.

High-speed stirred ball mills produce 2-micron mean size particles

The chosen stirred ball mill, called the HSA-100 Attritor, is used exclusively for fine, dry grinding and can operate at high speeds.

A high-speed stirred ball mill uses zirconium silicate balls as media for both baryte and calcium carbonate production to prevent color contamination.

In mill operation, unground material enters a stationary tank that's jacketed for temperature control. Cooling (or heating) liquid enters the jacket, a pump circulates the liquid, and the liquid then exits the jacket, causing continuous circulation of the temperature-control liquid. The tank contains grinding media, and the mineral supplier uses 2½-millimeter zirconium silicate balls as media for both baryte and calcium carbonate production to prevent color contamination. A rotating vertical shaft with arms agitates the material and media in the stationary tank, resulting in a fine, even particle dispersion.

The mill is generally used in a continuous mode, which means the material en-



Using an air classifier (left) more than doubles the high-speed ball mill's grinding rate.

ters the mill at the top and discharges out the bottom, using centrifugal force. The mill is used when smaller particle size (generally 325 mesh) materials are fed into the machine and micron-size end products are desired.

The mill can achieve the finest grade — a 2-micron mean size — at 750 lb/h. The mineral supplier, however, has increased that rate by using a classifier with the system. First, the mill grinds 3,000 pounds of mineral so that 80 percent to 90 percent of the mineral reaches 2 microns. Next, the material enters the classifier to separate fine and coarse particles. The fines are the finished product, and the coarse particles are returned to the mill and reground with a new batch of raw material. This procedure enables the mineral supplier to achieve a 2-micron mean size at a rate of 2,000 lb/h.

Mills cut costs

The Monterrey plant now receives truckloads of mined baryte and calcium carbonate that are unloaded and stored in sheds. Front-end loaders move the minerals to a roller mill for initial grinding. Screw conveyors then move the minerals from the roller mill into storage tanks. Screw conveyors also move the minerals to a stirred ball mill for fine grinding. The finished minerals are tested using a particle size analyzer and a brightness meter. A screw conveyor then moves the finished minerals to automatic baggers that pack 50-pound valve bags.

The results of using the stirred ball mills at the Monterrey plant have been positive. "I think the mill is probably the best on the market as far as efficiency and cost-effective operation," says Hughes. The mill has operated up to 10 times faster and more efficiently than a conventional ball mill. It's safe, easy to maintain, and, with its compact, vertical profile, requires minimal space and foundation requirements.

The mill also achieves the required material specifications. "If the material wasn't fine enough, or if it was inconsistent, we couldn't sell the product," says Hughes. "It simply wouldn't go into the end product unless it met the fineness specs. Really, the biggest advantage of fine-grinding is that it adds value to the mineral."

Contract grinding baryte and calcium carbonate increased transportation costs and material overhead. In-house grinding reduced both costs.

According to Hughes, the mineral supplier purchased the mills because of the equipment's simplicity.

"One of the biggest reasons we bought these mills for the Mexican market is because of the limited amount of variables

in running them, which helps to maintain a consistent product," explains Hughes. "They're very easy to operate. The controls on the system tell you when it's operating at peak efficiency. The machine's overall simplicity is what makes it attractive.

"The mill allows us to fine-grind calcium carbonate in Mexico, enabling us to enter and serve the Mexican paper industry," adds Hughes. "Our calcium carbonate mines are down there. We have the plant down there. And, now we're the only producer of fine-grind calcium carbonate in Mexico."

The mineral supplier also saves about \$5 to \$10 a ton in overall transportation costs for baryte production and no longer pays in advance for material that will then sit in storage until sold.

In the future, Milwhite is considering purchasing a high-speed stirred ball mill to wet-grind calcium carbonate for customers in the paper industry who handle their product in slurry form. **PBE**

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