

Roller Mill Grinders

Advantages, limitations and how roller mill grinders are changing for the better

In this current economic climate, companies are constantly searching for new processes, technologies and equipment to add value to their organisations and reduce costs. In this article by Scott Will, we will cover how roller mill grinders add value to many applications and reduce long-term processing costs. We also discuss recent technology improvements that further improve roller mill capabilities and efficiencies.

by Scott Will

Change for the better! Now that is something we all need a little more of these days.

For those of you unfamiliar with roller mills, the basic principal of operation is simple: Two parallel rolls rotate towards one another at high speeds, say 400 – 3000rpm. Material is gravity fed between the parallel rolls and as it enters the 'nip' of the rollers, it experiences both crushing and shearing forces that grind the particle into smaller pieces. Roll surfaces can be either corrugated or smooth on the surface, depending on the need, and typically a speed differential between the rolls, ranging from 1:1 to 3:1, is necessary (see figure 1).

Most roller mills are comprised of multiple grinding sections vertically stacked on top of one another and material falls by gravity from one pair of rollers to the next.

The number of sections is determined by the material properties and the amount of reduction required to achieve the desired grind size.

The roll corrugations, speed ratio between the rolls, and the gap between the grinding rolls are all precisely engineered for each product. The objective is to reduce the mate-

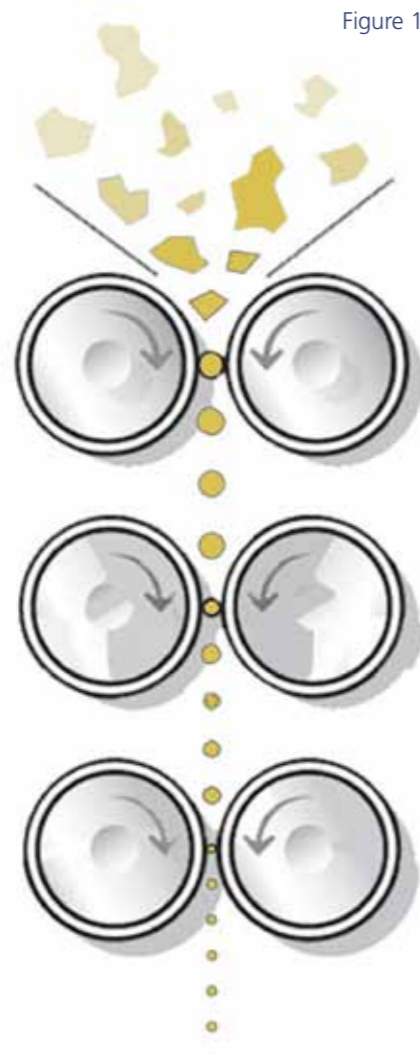


Figure 1

rial in size to a narrow particle size distribution and with few unwanted fines (see Figure 2).

Roller mill advantages

Now that we understand the basic principles of operation, there are four main advantages that direct people to use a roller mill rather than a hammer-mill, ball mill, cone mills or some other attrition grinding method.

Narrow particle size distributions. Fracturing of the material is accomplished only by the induced stress/shear action of the roll surface on the product. There is no attrition, high speed impact, or internal screening.

For many materials, this results in significant narrowing of the particle size distribution.

Minimal dust (fines) creation: Without high speed impact, dust generation is reduced.

Low temperature rise: With no high speed impact and since there is no recirculation of product inside the grinder, heat generation is minimal. Also, grinding rolls can be cooled internally for especially heat sensitive products.

Low energy consumption: There is no high speed particle impact and zero friction between particles; thus, a roller mill grinder typically uses 30-50 percent

less energy than an attrition mill of the same capacity. If you are wondering what savings that means in dollars, an additional 10hp costs our factory US\$6500/year (based on 24/7/365 at US\$0.10/kWhr).

Product Limitations

Due the low-impact grinding nature of roller mills, it is typically best suited for materials that break apart under pressure, otherwise know at 'friable' materials. This can range from polyester plastics used in solid surface countertops to coffee. Roller mills are also superior grinding systems for various abrasive materials such as limestone and elemental silicon.

In any case, we have listed the two most common product requirements for successful roller mill operation.

Only suitable for friable materials: The product to be ground must fracture under stress rather than flatten or deform. This does not mean that the product must be brittle; a roller-style grinder can be used for products as hard as elemental silicon or limestone.

However, materials like wood, rubber, and soft plastics are not good candidates for roller grinding.

Limited feedstock size: The maximum size of the feedstock (unground material fed to the roller grinder) varies based on the material properties; roll speeds and corrugations, and other factors.

Generally, the feedstock must be 25.4mm (1 inch) or smaller.

Changing for the better

Roller mill technology continues to evolve.

One of the greatest advances in technology involves roll materials. Today, various material advances allow roller mills to be utilized in increasingly abrasive applications. No longer are we limited to steel

Side bar: Obtaining a narrow particle size distribution should add value to your process.



“Roller-Style Grinders are typically more expensive than hammer mills but give better particle size distributions. If the only sizing concern is to reduce the material below a certain size with no limits to the permissible amount of dust or size consistency, then a roller mill grinder may not be appropriate for your needs”

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Realizing your future by your voice

“Some may still think of roller mills in its crudest form, with “crushers” haphazardly pulverizing friable materials down to a reduced size. But today’s precision roller mills are designed to produce “controlled explosions” that achieve a completely controlled and highly-engineered particle size”

or even hardened steel rollers. Modern roller mills use exotic roll materials, various coatings and in extreme cases ceramics that offer hardness values above the Rockwell C hardness

Modern manufacturing methods and CNC machines provide precision equipment tolerances that were simply not possible years ago.

Today, roll gaps can be held to 10 microns (+/-0.0005 inch) while rotating at 3000rpm. This allows roller mills to grind materials down to 50 microns, continuously and accurately, day after day and year after year.

Water-cooling also

grinding, especially with polyester, acrylics and other hard plastics. This is no longer necessary with the advent of water-cooling on roller mill grinders.

Additionally, various foods such as coffee and pepper boil off volatile oils and aromas above 35 degrees C (95 degrees F). Water-cooling eliminates product temperature rise as materials pass through the grinder, thus eliminating the need for expensive liquid nitrogen and simultaneously improving product quality.

Today’s precision rollers

Roller mill technology has evolved and become much more refined over the past 50 years.

Some may still think of roller mills in its crudest form, with ‘crushers’ haphazardly pulverizing friable materials down to a reduced size. But today’s precision roller mills are designed to produce ‘controlled explosions’ that achieve a completely controlled and highly-engineered particle size. Friable materials can now be reduced in size with less dust, greater uniformity and higher efficiencies.

Not only is this change for the better, but this is change for the better than can be proven and quantified.

Granulizer Critical Design Elements:

- A) Roll Cut Shape and Size
- B) Roll Speed Ratio
- C) Roll Gap Distance

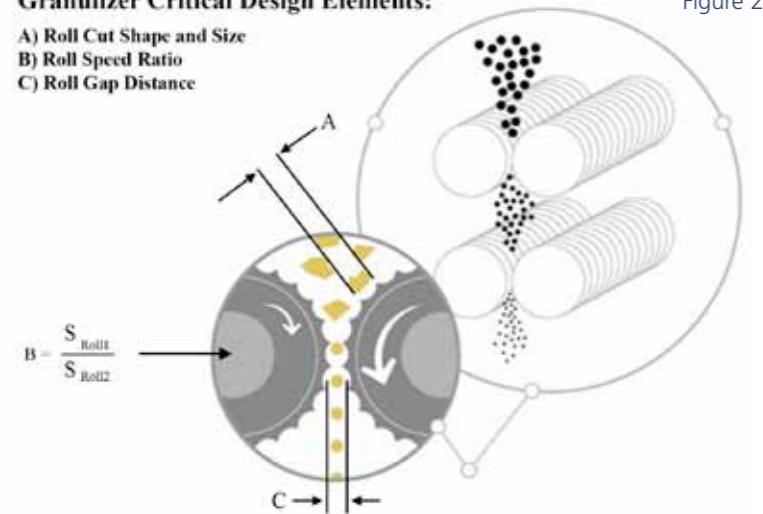


Figure 2

scale. These coatings and ceramics can virtually eliminate wear numerous applications.

plays a part in expanding applications.

In the past, cryogenic grinding methods were required on a number of applications to eliminate heat elevation during

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