

Gebr. Pfeiffer SE

PFEIFFER GC mills type MPS for grinding, drying and calcining

Gebr. Pfeiffer SE was founded in 1864 by the brothers Jacob Pfeiffer and Karl Pfeiffer. The medium-sized corporation is still family-owned and is active in the fields of grinding, separating, drying, calcining and lime hydration. It currently employs about 400 staff members and has its own production plant including a foundry in Kaiserslautern, which is about 100km southwest of Frankfurt, Germany. Its customers and projects can be found all over the world, mainly in the cement, lime, gypsum and ceramics industries.

Overview

As early as 1963, Gebr. Pfeiffer SE supplied the first MPS vertical roller mill and the first gypsum kettle to the gypsum industry. The first whizzer-type classifier, SUV, followed 10 years later. In 1998, the MPS-GC roller mill for drying, grinding and calcination in one step was introduced (Figure 1). Up to now, 26 gypsum calcining mills have been sold, among them in 2011 the two largest gypsum calcining mills in the world with throughput rates of up to 90t/hr.

The MPS mill can be used universally to process natural gypsum or mixtures of natural gypsum and flue gas desulphurised (FGD) gypsum and/or recycled material. Depending on the gas temperature after the classifier and thus the material temperature, this mill offers the possibilities of grinding, drying, partly calcining as well as grinding, drying and complete calcining into beta hemihydrate plaster. Due to the mill's technical design, there are no limits regarding the construction size and the throughput rate.

Gypsum calcining mill operations

In order to generate the required energy for the drying and calcining of the gypsum, the mill has to be operated at a relatively high temperature. The required gas temperature after the mill is around 160°C. The hot gas inlet temperature at the mill is up to 600°C. These high temperatures lead to high thermal loads, for which the mill has to be accordingly designed.

All areas that are exposed to high temperatures have been designed as segments (Figure 2) or replaceable parts. The single-part nozzle ring rests on a flexible support, which helps to equalise the high expansion due to the high temperatures. The

grinding bowl is exposed to up to 600°C from below by the hot gases, while it is cooled from above at the same time by the gypsum which is fed in. To keep the thermal stress as low as possible, the grinding bowl is equipped with special heat insulation and a heat shield in the hot gas area (Figure 3).

Like all Pfeiffer MPS-mills, the gypsum calcining mill also starts with lifted grinding rollers. On the one hand, this leads to a lower voltage peak when starting the mill motor. On the other hand, it allows for an equal heating up of all mill components, in particular the grinding bowl. Since there is no or only little material on the grinding plate during the heating up phase, the lifting of the grinding rollers ensures that there is no metal to metal contact between the grinding rollers and the grinding plate.

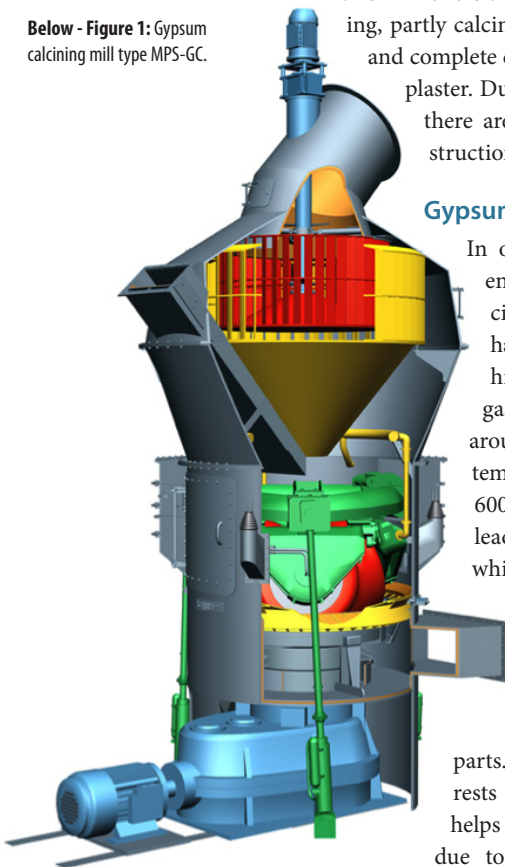
All MPS mills have three stationary grinding rollers. These form a statically defined system. The load on the thrust bearings of the mill gearbox due to the grinding forces is therefore very equally distributed.

Due to the roller bearings inside the grinding rollers, light and equal rolling of all three grinding rollers is guaranteed. Because of the high temperature level during gypsum calcining, all gypsum calcining mills are equipped with a forced lubrication system. Fresh oil is constantly pumped onto the bearings from outside so that the bearings are not only lubricated, but also cooled. The oil is filtered in the oil supply unit and cooled down again.

To avoid dust from getting into the grinding roller bearings or the rotating mechanical seals, there are air sealing rings between the stationary and the rotating parts of the grinding rollers. During the whole operation time of the mill, fresh air is pressed there through a defined gap and serves as seal air. This prevents any dust from getting to the roller bearings.

In case the gypsum calcining mill has not been in operation for a long period of time, it is first heated up for restart without material. After a period of 45–90 minutes, depending on the mill size, the mill operation is switched on again, the first gypsum is fed into the mill and the grinding rollers are lowered. The initial feed rate is lower than the nominal

Below - Figure 1: Gypsum calcining mill type MPS-GC.





throughput rate. The throughput rate is slowly increased over a period of about 2.5-5hr, again depending on the mill size. The control of the plant ensures that, on the one hand, the temperature of the mill remains sufficiently high so that no dihydrate gets into the product and that on the other hand, the hot gas inlet temperature before the mill does not increase too quickly.

To be able to operate the gypsum calcining mill with a very low throughput rate both during heating up as well as in continuous mode, the mill speed is adjusted accordingly with a frequency-controlled drive motor. The speed-controlled drive makes it possible to reduce the plant to about 50-60% of the nominal throughput rate in continuous operation. The vibration level is not increased by this because it is always possible to select the mill speed which is optimal for the throughput rate.

Every gypsum calcining mill comes with an integrated high-efficiency classifier. The classifier with its design of closest gaps between rotating and stationary components makes sure that the beta hemihydrate gypsum has a steep particle size distribution. The fineness of the product is set via the speed of the separating wheel. For this, the separating wheel drive is equipped with a frequency converter. The temperature of the classifier bearing system is monitored.

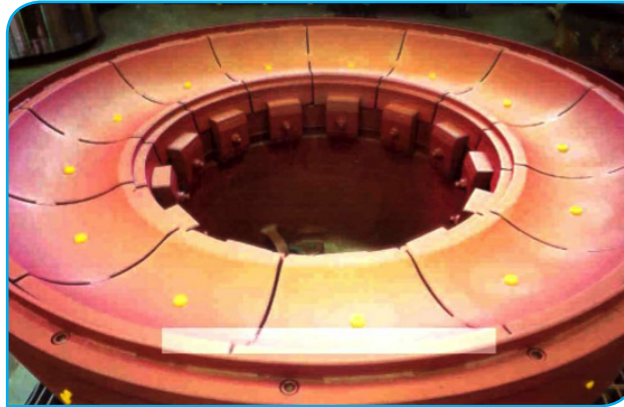
The feed of the raw gypsum into the mill is usually carried out with a self-purifying rotary air lock and a heatable material inlet chute through the classifier. Through this type of feed, it is ensured that the material to be ground is equally distributed on the grinding plate at all three grinding rollers.

The inclined material inlet chute cannot be used when the material to be fed in is very sticky, e.g. when there is a higher portion of FGD gypsum in the blend. In this case, the feed is done via a double shaft screw conveyor also into the centre of the mill (Figure 4).

Summary

In summary, it can be stated that the PFEIFFER MPS-GC gypsum calcining mill can be used for a broad range of feed materials. Apart from the feed of pure natural gypsum, it is possible to add up to 50% of FGD gypsum or additionally up to 20% of recycled material.

The technical design of the mill itself and the type of control and monitoring of the complete gypsum calcining system make it possible to produce beta hemihydrate plaster with very consistent setting times. Through the setting of the gas temperature after the mill, the quality of the product is set in such a way that there is no unburnt material in the product and that the share of anhydrite III can be minimised.



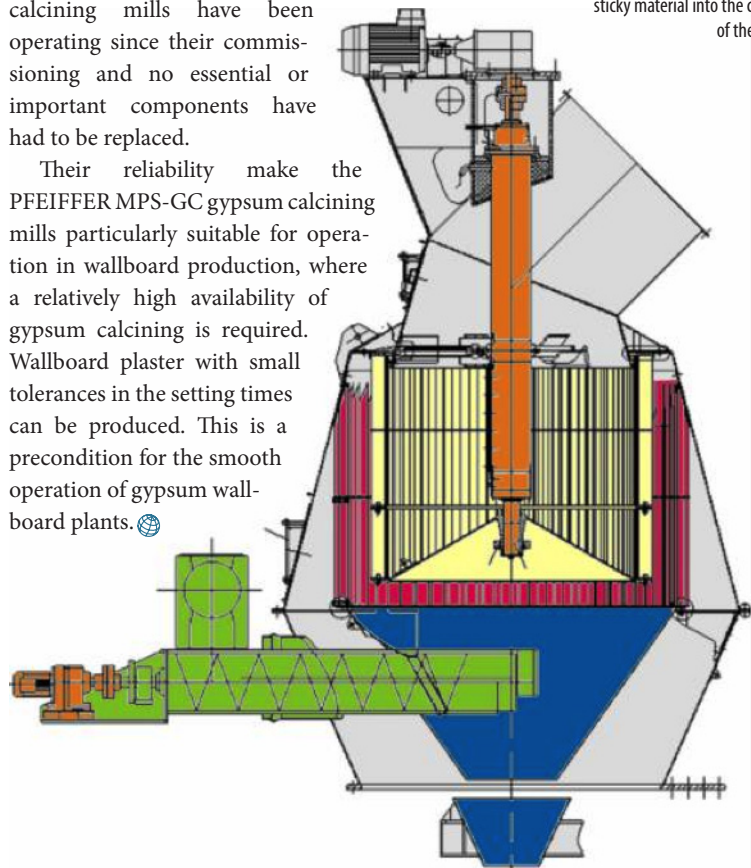
Left - Figure 2: Segmented grinding plate with clamped elements.



Left - Figure 3: Heat shield and thermal insulation for grinding bowl in hot gas channel.

The design measures guarantee that the gypsum calcining mills can withstand both the mechanical as well as the thermal stress very well. All of Gebr. Pfeiffer's currently operating gypsum calcining mills have been operating since their commissioning and no essential or important components have had to be replaced.

Their reliability make the PFEIFFER MPS-GC gypsum calcining mills particularly suitable for operation in wallboard production, where a relatively high availability of gypsum calcining is required. Wallboard plaster with small tolerances in the setting times can be produced. This is a precondition for the smooth operation of gypsum wallboard plants. 🌐



Below - Figure 4: High efficiency classifier with double shaft screw conveyor for feeding sticky material into the centre of the mill.