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Recycling gypsum wallboard: Turning construction waste into a chemically-pure resource

EU regulations, the reduction in FGD gypsum from lower coal use and increasing construction are among the many reasons that wallboard recycling is becoming more attractive. However, the process needs to be cost-efficient. To this end, BHS-Sonthofen has developed a process that entails two crushing stages. This even makes it possible to recycle any adhering impurities...



Above: Alfred Weber, Sales Director at BHS-Sonthofen.

Gypsum is a very popular mineral, used not only in wallboard for indoor refurbishment products, but in vast quantities by the global cement industry. Construction as we know it is virtually unthinkable without it, whether it is solid gypsum, gypsum wallboard or gypsum fibreboard. There are many good reasons for this. Gypsum does not burn, is easy to process, acts as a sound insulator and has a positive impact on the indoor climate. The consumption of this raw material has been increasing in recent years.

Gypsum shortage due to coal phase-out

For many years the gypsum used has been a mixture of mined gypsum and flue gas desulphurisation (FGD) gypsum. This is popular in countries such as Germany that have a high traditional use of coal for power generation and SO_x emissions limits that necessitate the use of scrubbers. However, Germany is set to completely shut down its coal-fired power plants by no later than 2038. As early as 2030,

Germany will likely produce only half as much FGD gypsum as today. This will result in a significant supply shortage in view of increasing demand.

Gypsum waste recycling is the solution

At the same time as FGD gypsum will become more scarce, sustainability will also become increasingly important in the construction materials industry. This is due to political and societal drivers. The EU issued a directive in 2008, which requires Member States to achieve a 70% recycling rate for construction and demolition waste by the end of 2020. Another directive also stipulates that gypsum waste must be landfilled separately from biological waste in separate cells. This makes disposal an expensive proposition.

Given this backdrop, there are many reasons why it is high time to introduce an efficient process that allows gypsum waste to be recovered economically. A recycling system can prevent a shortage of gypsum, while saving construction companies from paying high disposal fees.

A daunting task

Gypsum waste is generated at various points in the lifecycle of the mineral, including during the production of wallboard and other gypsum products. In particular, gypsum waste generated on construction sites or during demolition work contains numerous other substances in addition to gypsum. This includes screws and nails, wood, wallpaper or steel lattice scraps, as well as pieces of brick. However, many machines cannot process such a varied feed material. Moreover, it is often difficult to separate the materials according to type. This task requires a sophisticated system comprising consecutive sorting technologies. The end product must be of such high quality that it presents a real alternative to FGD or natural gypsum. In addition, the efficiency of the procedure remains a basic prerequisite.

Below: The two shafts of the type VSR pre-shredder are equipped with shredding tools that can easily handle impurities in the gypsum waste.





Above: The BHS type PB impact crusher. The combination of shredding and impact crushing produces particularly pure recycled gypsum.

Maximised yield with the BHS process

BHS-Sonthofen has developed a complete system, the individual components of which are optimally aligned towards cleanly separating the gypsum from other components in the feed material. To ensure maximum efficiency, the remaining fractions should also be cleanly separated by type and made available for recycling. The system implements a two-stage process for this purpose: A combination of tearing technology and impact crushing prepares the material for classification. The core components of the system are its two shredding loops.

Two crushing stages result in clean separation by type

A two-stage process with pre-shredding, for which BHS uses a VSR type pre-shredder, represents a new take on recycling gypsum waste. The VSR is a two-shaft shredder. Its two shafts are equipped with tearing tools. The fed gypsum boards fall down and out of the machine as soon as they have been pro-

Below: The final product is chemically identical to natural gypsum.



cessed to the desired size. The decisive advantage of this technology is that, in contrast to cutting machines, the pre-shredder can handle the metallic impurities in the feed material. Overhead magnets, zig-zag sifters and various screening cycles already pre-sort the material after the first shredding stage. Larger metal parts that might interfere with the further recycling process are thus collected in separate containers.

In a second crushing stage, a type PB impact crusher with a horizontal shaft separates the gypsum particles from adhering impurities. This allows the plaster to be cleanly separated from boardliner residues, wood fibres and small metal parts.

Ivan Glamuzina, Senior Project Manager in the Recycling & Environment division at BHS, sees the strength of the overall process in the combination of the two processes. "Gypsum boards have strongly adhering boardliner elements and many other impurities, which is why they represent a real challenge to recycling technology," explains Glamuzina. "BHS is one of the few manufacturers to have mastered both the tearing and the impact process. This allows us to optimally combine the advantages of different machine types and to ideally align all components with one another."

The fine, multi-stage classification step yields various fractions of high purity. Due to this smart process, BHS has succeeded in preparing not only gypsum but also the paper and metal contained in the gypsum waste for recycling in a highly efficient manner.

Chemically pure gypsum

The recovered gypsum (RC gypsum) is chemically identical to natural gypsum. Therefore, the recycled material can be used in any desired application. An RC gypsum content of up to 70% (of the 5% gypsum in cement) is already common practice in cement production today.

Wallboard manufacturers are more circumspect and tend to gradually increase the proportion of RC gypsum to assess the quality of the wallboard produced. Some already use 25% RC gypsum in their wallboard and initial tests with 40% RC gypsum have shown promise. There is no loss of quality compared to products made of non-recycled material.

In view of the current developments in environmental protection and the growing construction industry, Ivan Glamuzina is confident. "The recycling of building materials – especially gypsum – will become increasingly important in the coming years. The two-stage process reliably provides our customers with a cost-efficient means of obtaining a high-quality product." 