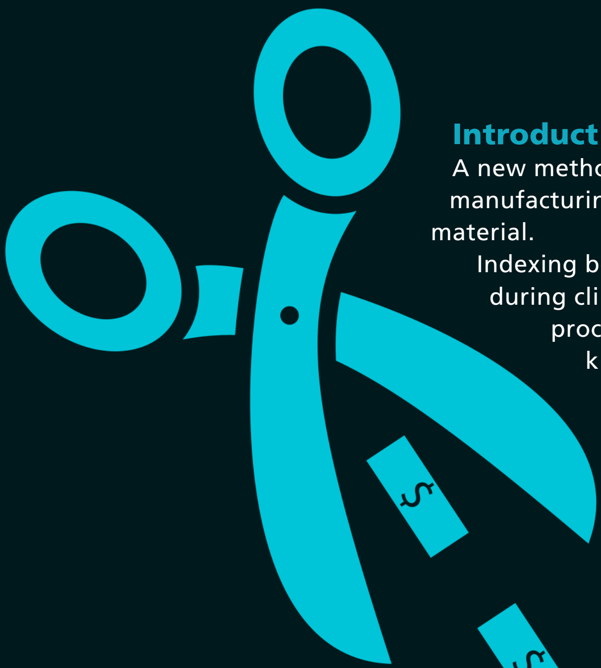
Use Bypass Dust, Reduce Energy Costs



Christian Steinbinder, BHS-Sonthofen, describes the improved performance of a new belt filter.

Introduction

A new method allows the use of up to 100% alternative fuels (AFs) for clinker manufacturing and the recovery of the resulting bypass dust as a recyclable material.

Indexing belt filters from BHS-Sonthofen enables the bypass dust accruing during clinker manufacturing to be completely reincorporated into the process by using up to 100% of more cost-effective AFs in cement kilns. Reincorporation of the salvaged bypass dust increases cement production by up to 3%. Proof that the method works reliably on a commercial scale is provided by a new plant with a capacity of 20 000 tpy.

Fuels such as coal, oil, or gas used to manufacture cement are increasingly being replaced by more cost-effective AFs, such as car tyres, plastics, sludge, and municipal and industrial waste. The percentage in Europe has already increased to 60% and will rise further in the years to come.

More chlorides are released in the combustion process when using AFs, compared to fossil fuels. These chloride salts evaporate in the sintering zone, which results in the formation of internal circuits (gas recirculation). The subsequent condensation causes the chlorides to concentrate in the hot meal and thus, create baked-on deposits in the plant components. Therefore, the chlorides must be discharged from the cement kilns using a gas bypass. The chlorides present as gases in the kiln infeed and settle on the bypass dust during the cooling of the gas flow extracted from the gas bypass.

This dust exhibits a chloride content of up to 20% in many cases. It cannot be added back into the

BF series indexing belt filters: gentle filtration of sedimenting substances

The BHS indexing belt filter is a continuously operating, horizontal vacuum filter used for the efficient and gentle separation of sedimenting solids from suspensions. The filter cake forming on top of the belt can undergo further treatment in a wide range of process steps, demonstrating the high process versatility of the indexing belt filter. As a result, the filtrates can be individually recovered and processed. This makes the indexing belt filter very flexible in its application.

The filter medium is an endless belt with a stepwise movement. Feeding of the suspension is usually continuous. The vacuum trays are fixed in place on the frame. The filter cloth with the suspension moves stepwise over the trays. Each time the cloth stops, the filtrate is sucked downwards and the vacuum is switched off. This releases the filter cloth, which can be advanced again.

The filter cake forms on top of the belt and can undergo further treatment by washing (co-current or counter-current), reslurrying, steaming, extraction, vacuum drying, or pressing. The wash filtrates can be recovered individually from each vacuum tray and further processed without any cross-contamination. The filter cake is discharged at the discharge roller and the cloth is cleaned as the belt returns.

cement, as the maximum permissible chloride content of 0.1% is exceeded in the end product.

Indexing belt filters reduces the chloride content

So that cement plants can also take advantage of the cost benefits of AFs and, at the same time do away with disposal costs for bypass dust, the system manufacturer A TEC developed a patented process in cooperation with LafargeHolcim. This process was realised in a factory located in Rohoznik, Slovakia, as a complete industrial-scale system with a BHS belt filter. It reduces – even when starting with high concentrations – the chloride content of the dust to below the desired threshold. The BHS belt filter, which assumes an important process step in this system, achieves a chloride wash-out efficiency of more than 95%. Therefore, the bypass dust can be added to the cement again – i.e. sold – even when using secondary fuels. The concept from A TEC and LafargeHolcim is also based on the recovery of valuable potassium chloride (KCl) salts from the filtrate, thus turning the bypass dust into a resource for new recyclable materials. Furthermore, the system requires only a minimal amount of water.

The core element of the system is the type BF BHS indexing belt filter. The gas flow extracted from the burning process, with which the bypass dust is discharged from the system, is cooled and made free from dust. The dust separated in the filter system is sludged with washing liquid and then filtered, washed efficiently in multiple stages counter-current wise, and mechanically dewatered to the greatest possible

A type BF 200-080 BHS indexing belt filter, shortly before commissioning, still without the filter cloth.

extent. The material flows extracted from the belt filter are a mother filtrate concentrated with chlorides, which is treated or disposed of, as well as the washed out filter cake, which is added back to the cement.

BHS uses indexing belt filters compared to filter presses, as they are advantageous for typical flow rates of approximately 3 – 9 tph of total solids. They are especially suitable for high flow rates because they work continuously. The multi-stage counter-current washing of the filter cake works efficiently, while the special mechanical dewatering system makes ongoing use of the filter cake easier. The belt filter system is fully automatic, including the cake discharge and filter cloth washing. The belt filter is easy to clean and the maintenance costs are low.

The technology in detail

The dust, to which the chlorides and combustion residues stick, is first conveyed from the storage silo into a mixing unit, where it is sludged with water or filtrate, then pumped to the indexing belt filter and continuously fed onto the belt.

The BHS indexing belt filter is operated in cycles: the belt stands still while filtration is active and the vacuum is applied. The filtrate is drawn off in the filtration zone and an even filter cake is formed. The trays under the filter cloth are ventilated at the end of the cycle and the belt moves in the direction of the washing zone by one zone length.

A bypass dust filter is typically equipped with two or more washing zones. The washing filtrates are extracted and collected separately. The filtrate from the first washing stage can be used to prepare the suspension; the filtrate of the second wash is recycled and used for the first cake washing. As fresh water is only used in the second stage, the need for fresh water is reduced to a minimum.

With this two-stage counter-current process, BHS achieves a washing efficiency of more than 95% – considerably more than using two parallel washing stages using the same wash ratio, both of which need to use fresh water. The first washing filtrate to be released as a result of this operation contains a high concentration of chlorides. It is used to sludge the dust.

After washing, the filter cake is cycled into the dewatering zones. In order to reduce the residual moisture content of the filter cake, water is removed initially by vacuum drying. An additional pressing device, only offered by BHS, follows this zone. Here the filter cake is mechanically compressed. At the same time, compressed air is blown through the pressing device and filter cake, which dissipates the pore fluid in the cake. This allows a perforated plate covered with a filter cloth. The pressing force is 3 – 6 bars, depending on the filter width; the blowing pressure is between 1 – 2 bars.

Using this combination of an indexing belt filter and an additional pressing device, BHS reduces the residual moisture in the bypass dust to 25 – 30%, a value that could never be achieved using normal suction. The value also falls below the thixotropic point and handling is improved, asthe dried filter cake is crumbly and can be transported away by the conveyor belt and directed back into the process.

The cake is removed from the filter cloth at the end of the filter, supported by a scraper. Special filter cloth washing is installed after the discharge, which mechanically removes adhering product residues from the filter cloth. The discharge from cloth washing can be used for cake washing. This method further minimises the use of fresh water, and the solids contained in the cloth washing water can be directed back into the filtration process.

A worthwhile investment

Once the bypass dust leaves the belt filter system, its chloride content is far below the level of the accruing dust from the gas bypass (wash-out rate > 95%) and all the dust can be directed back into the process.

The bottom line: even if cost-effective secondary fuels replace conventional fuels for the calcination of the raw material by 100%, the accruing bypass dust can be directed back into the process. The hloride-containing filtrate that is removed from the system can be treated or disposed of.

BHS provides a complete solution for treating the bypass dust. The scope of supply includes the dosing and mixing station, the filtration system (with filtration of the suspension, cake washing using a multi-stage counter-current method, and the cake dewatering), and all pumps and the separators, as well as the complete array of measuring and control technology. The system is therefore easy to integrate into the existing process as a skid-mounted module.

Summary

With a new complete solution for the treatment of bypass dust, BHS makes it possible to use cost effective AFs for cement production, such as auto tyres, plastics, sludge, and municipal and industrial waste, in place of conventional primary fuels, such as coal, gas, and oil. The central element is the treatment of bypass dust containing chloride using an indexing belt filter. It removes the chlorides and residues that result when burning these substances, so that 100% of the bypass dust can be directed back into the manufacturing process and sold. As a result, the BHS belt filter increases cement production by up to 3%. The end products of the process are only recyclable bypass dust and a filtrate concentrated with chlorides and combustion residues.

About the author

Christian Steinbinder is a Project Manager at BHS-Sonthofen, where he works in the Filtration Department. He is responsible for flue gas desulfurisation, gypsum dewatering projects, and other key applications. Steinbinder studied process engineering at the Nuremberg Institute of Technology and holds an engineering degree (Diplom-Ingenieur).