AIK
TECHNIK AG

Optical sorting for building materials recycling

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Optical sorting
possible process flow

The existing end components with a high foreign-matter content can be adjusted using optical sorting to the specified standards after preparation.

By installing a high-performance strong-field iron separator and a subsequent eddy current NE separator, it is possible to efficiently separate ferrous and non-ferrous metals that would otherwise interfere with the optical sorting process. In order to achieve a uniform and good distribution of this material, the material is fed onto a conveyor trough after the washing and sorting processin order to achieve an even and adequate distribution. Before the material is optically sorted, a screening machine removes possible fine particles that would interfere with the sensor sorting process and contaminate the machine/ sensor section. A feed chute feeds each of the sorting machines or several sorting machines located one behind the other.

The surface of a foreign or mineral material can be identified by its color, transparency and shape if it is sufficiently clean. However, transparent glass, so-called „white glass“, can only be identified by the transmitted light method (transmission), which can be used in a sensor sorter. For this purpose, detection must take place on a short glass slide, which is also referred to as a transmitted light plate.

The sorting machine is also able to detect and remove foreign materials. This is done on the basis of further exclusion criteria such as color, for example „black“ like slag, asphalt or „red“ like bricks. This detection is carried out using the reflected light method / re-flection. The sensor sorters have a built-in metal detector bar that detects objects with a certain amount of ferrous and/or non-ferrous metals.

The output material is blown into the ejector by the electrical and magnetic properties. It is blown out at the same time as other foreign matter detected by the optical sensors.

The cleaned components are then transported by conveyor belts to the silo distribution system. From the silos, they are then loaded onto trucks either as individual components or mixed according to a specific procedure. To ensure that the plant operates with maximum efficiency, a modern control system is required.

Prinzip
the sensor sorting

Sensor-based sorting is an improved, automated version of conventional manual sorting. Different sensors are used to sort the material faster and more efficiently. In this way, errors during sorting can be minimized.

The sensors measure the properties of the particles and thus specify the separation criteria. This system analyzes the measurement data and separates the particles mechanically / pneumatically accordingly, without having to rely on material properties.

The sensor sorting works with the help of two devices, the belt and the vibrating chute. The separating unit, consisting of individual air nozzles, can have larger or smaller distances from each other.

These are generated by the different vibrations of the chute, which in turn is vibrated by the belt. The gravel is thus transported on the belt and sorted by the different distances between the nozzles.

Through our optimization of the process steps, we achieve significantly lower good material rejection.

Advantages
the optical sorting

The following is a summary of the advantages of the AIK optical sorting process.

Criterion / Feature	Advantages
Production disruption	No major interventions in the existing producing plant necessary
Service interruption	Minimal interruption of the existing plant during the conversion (connection electrical / control)
Technology	Use of proven machine technology that is in daily use worldwide
Space utilization	Can be adapted to existing installations
Process engineering	Task optimization (also in terms of performance, cleaning, etc.). Maximization, processing possibilities and product quality. Minimization of missed shots and thus good grain losses
Construction	Robust, heavy, durable
Lifetime	Long Life
Access	Optimal access is ensured for inspections and maintenance work
Operation	Operation, monitoring and maintenance are easy to handle and will be shown and instructed by us on site
Consideration of operator wishes	Individual operator needs can be and are met flexibly and cost-effectively and operator wishes taken into account
Expandability	Possible in different lines

Features and limits
the optical sorting

- Coarse glass is usually effectively separated by the sensor sorter, regardless of whether it is wet or dry.
- However, fine-grained moist to wet material can stick to the belt and skid plate, often making processing on the FE and NE separators or sensor sorting impossible.
- Separating the residual slag (4/8 mm) after FE separation with a metal detector bar is often not very useful, since the residual slag parts often have hardly any FE content.
- The residual slag can be separated by illumination layer/reflection (black).
- The residual spheres in the grain size range - of 8/16 mm are easily detected and separated by the metal bar.
- Sensor sorters could be equipped with transmitted light and reflected light systems at the same time, but this would not improve the quality. On the contrary, the quality and selectivity would be lower.
- The combination of transmitted light sensors and the metal detector bar or reflectedlight sensor with a metal detector bar works well when operating simultaneously but with a slight loss of separation efficiency, i.e. glass and lead separation interfere with each other.
- The sensor sorter can be used as a pure control device during the processing of bullet traps. Thanks to its strong metal bar, it detects even the smallest residual balls and separates them cleanly. This makes it the perfect solution for a clean end product.
- Sensor sorting with nozzle spacing of 6.25 mm also works for small fractions or pieces like 4/8 mm.
- The sensor sorter with a nozzle spacing of 3.125 mm will increase the separation efficiency for pieces of 4/8 mm, but reduce the air pulse and thus the separation efficiency for the pieces of 8/16 mm and 16/32 mm grains.
- The sensor sorter has an automatic sword adjustment - this ensures reliable and efficient work.

Detection
different assortments

Detection is the process of searching for and finding raw materials in the gravel. There are different methods for this, but they differ significantly in their reliability. Some detection methods are very accurate, others are less reliable.

Overall, the following four detection methods differ:

- Positive detection: Here, the valuable mineral sought is detected.
- Negative detection: In this method, the secondary rock is detected.
- Double detection: Both the value mineral and the surrounding rock are detected.
- Indirect detection: pieces containing recyclable material are identified by means of indicator minerals.

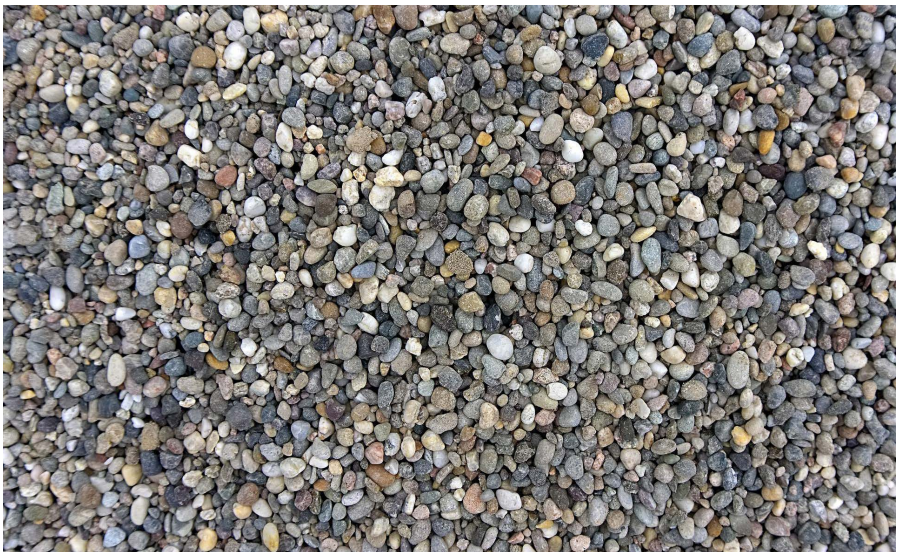
A sensor that detects surface features is very useful for most applications. This requires a clean or washed surface. However, it is not possible to make any statement about material composition inside a grain or particle, since it has only a very small penetration depth. A sensor that can detect all material properties of the entire grain is limited in grain size and penetration depth. In a completely dry process, even unwashed, contaminated material is detectable.

We offer sensors that can detect various material properties such as elemental content and mineralogical composition. These include color, reflectance, transmission, electrical conductivity and thermal conductivity. Density, magnetizability and gamma radiation emission can also be sorted.

The sensors can theoretically process materials with a minimum grain size of 1 mm and a maximum grain size of 30 mm.

Single particle detection and the maximum detectable number of particles is limited to max. 40'000 particles/second. The energy consumption is approx. 1 - 2 kWh / t.

Sensor sorting has been used in various fields for a long time and has proven its worth. For example, it has a long tradition in the extraction of valuable ores. However, the use of this method is not yet widespread in gravel, RC, excavation and soil washing processing plants. In general, the separation rates are good for bricks, but lower for other materials / by-products. Optical sensors (visible light with line scan cameras) are mainly used for gravel. Differences in color, brightness, reflection and transparency are detected. For this purpose, the material to be deposited must be sufficiently differentiated, i.e. differences in shape or color should be clearly visible.



Sensor sorting experiences and recommendations of AIK Technik AG

Bricks can be easily recognized by their red color in the white-yellowish-gray-brown-black gravel and thus be separated from it. This is a simple process, unlike most other previous possibilities.

The color recognition for glass is washed, while material which is still moist is easier to recognize than dry material covered with fine dust is. On the other hand, moist material, especially with finer grain sizes, can partially stick to chutes and belts. The separation of yellow bricks is only possible with an increased good-grain reject and lower chipping rates. The separation of glass is more difficult: colored glass can be recognized by its color if the surface is clean. In order to separate especially transparent glass, „White glass" to be detected, however, transmitted light methods are necessary.
For an optimal sorting result, it is important to feed the material to be sorted in a narrow grain band. There are several reasons for this: If the material is uniform, the parts will fall at the same rate. Different materials have different slipping speeds, so that only a medium speed can be set. Small material thus cannot be in the „shadow" of larger parts. The output required for the different grain sizes is not the same.

When processing coarse materials (32/63 mm and 16/32 mm), good results are generally achieved. However, the finer the grain size (8/16 mm and 4/8 mm), the more difficult it is to achieve good separation rates. This considerably reduces the ton output per meter of machine width.

The correct belt solution for a sensing machine is critical to the machine's performance. The belt solution must have a good feed chute and be long enough not to subject round material to relative velocity (rolling) during sensor and discharge. The machines of one manufacturer can usually only be equipped with one type of sensor, while other machines support several types at the same time. The space required varies mainly in length. Ancillary equipment such as a powerful compressed-air supply and an exhaust-air extraction system with dust removal are necessary, the latter is mainly to be planned as a minimum.

Sensor technology is subject to continuous further development. Improvements have been made above all in terms of resolution, the number of particles that can be detected, the evaluation speed and program development. Which type of sensor sorter is best suited depends on various factors, such as the material to be processed, the foreign matter to be separated, and the desired end product and degree of purity. Manufacturers offer test facilities in which the machine can be tested. Alternatively, one can also turn to plants already in operation.

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