Press release

Hardheim, September 2017

Pioneering mixing technology for the production of friction linings

Friction linings in the form of brake and clutch linings on the basis of organic binders are highly important products. Kinetic energy is converted into heat by friction. The friction performance of the friction lining must be constant at all times and no fluctuations in the compressive strength, shearing strength or material hardness can be tolerated anywhere on the lining. The mixtures which are pressed to form friction linings have to meet very high requirements in terms of homogeneity. In this regard top-name manufacturers therefore place their faith in preparation technology from EIRICH, which also enables them to prepare both dry and wet mixes in one and the same machine. This year has seen a good number of such mixers designed once again.

Friction linings consist of a large number of materials, with anything up to 50 in a single formula. The manufacturers' formulas are developed for and tailored to each specific application or specific customer requirements. The ingredients are inorganic fillers (e.g. chalk or iron oxide), lubricant materials (e.g. graphite or coke powder) and metals (e.g. copper, brass or iron) in powder, grain or fiber form. Synthetic fibers on the basis of aramides are often used as well, since they do not melt under the influence of heat but become carbonized instead. Resin for binding is also added, and this becomes carbonized under the influence of heat during the course of production and binds all the particles together.

There are four different international categories of friction materials. Friction materials falling under the "Semi-metallic" category contain 30% to 65% metal, mixed with graphite, fillers and binders. Friction materials in the "Organic" category are made of fibers (glass, carbon or aramides) along with fillers and synthetic or natural resins. Friction materials in the "Low-metallic" category are comprised of the aforementioned organic materials mixed with 10% to 30% of metal, generally copper or steel. Whereas these three categories of materials have been used for decades, the fourth category of friction

materials, “Ceramic”, is relatively new. These friction materials are comprised of ceramic fibers, fillers, binders and a small amount of metal.

What all the categories have in common is that very light materials, very dense materials and fibers have to be mixed together to optimum effect – which is a real challenge for any mixer, especially since the fibers have to be locked up. From the literature it is known that mixers demix during the mixing process, because the mixing process is superimposed by a demixing process. This applies in particular to mixes involving raw materials with different densities. Investigations into “Determining the mixing time on a horizontal single-shaft mixer” (plowshare mixer), for example, involving two test substances, showed that the maximum possible mixing time was no more than just 120 seconds. Mixing for any longer results in demixing effects in the two components. This can be explained by the different motion patterns of the components in the mixer resulting in a gradual accumulation of the heavy components in the peripheral areas.

In practice this means that the mixing process in a plowshare mixer cannot be carried out for an indefinitely long period and that the best attainable mixing quality for each mix has to be determined by running a series of measurements, with the resultant mixing quality not generally being the optimum. These facts apply to all mixers in which the material being mixed is moved by mixing tools.

What, therefore, is the best way to mix if you want to achieve optimum mixing qualities and do so without any demixing? Very simple: You use a mixing system in which the material being mixed is not moved by mixing tools, but by a rotating mixing pan instead. This is how the mixing principle of the so-called EIRICH mixer works, a mixer which always comes into play in a wide range of industries when other mixing systems have reached their limits due to their design. Numerous investigations have shown that it enables mixing qualities to be achieved which are generally beyond the capability of other systems. In most cases there is no need for the raw materials to be added in a set order either, unlike with simple mixers.

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Since the movement of the material (by the rotating mixing pan) and the mixing process (by the mixing tool, called a rotor) are separated from one another, there is no limit to the speed at which the mixing tool can be run and speeds of up to more than 30 m/s are possible. This mixer therefore has no need for high-speed choppers to lock up the fibers. And Froude numbers can be achieved which are a multiple of those attainable by a plowshare mixer. As a result, the EIRICH mixing system can be used to process any desired consistency. The mixes used for friction linings are generally dry mixes or mixes involving resin solutions –no problem at all for the EIRICH mixer. Both mixes can be produced on one and the same machine. It even processes viscous resin solutions without any difficulty whatsoever. With EIRICH technology manufacturers can be sure that they can produce mixes involving both powdery and liquid resin on a single machine if required.

Customers – among them the top-name manufacturers of friction linings throughout the world – also appreciate the system related low wear associated with these mixers, and the fact that they are relatively easy to clean. For them this is yet another reason to stick with EIRICH technology when it comes to production expansion as well. Mixers used for friction linings generally have an effective volume of between 75 and 1500 liters and are normally fitted out for ATEX zone 20. Due to their design, upscaling is also relatively straightforward. This enables formulas for test mixtures to be transferred to production mixers with ease.

Test center facilities are available at all EIRICH sites around the world to enable the system related advantages of the special mixing technology to be demonstrated using the customer's own raw materials. In comparison to a plowshare mixer the mixing times are significantly shorter in most cases, which means that smaller mixers can be used.

Further information:

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The EIRICH Group, with Maschinenfabrik Gustav Eirich as its strategic center in Hardheim, is a supplier of industrial mixing, granulating/pelletizing, drying and fine grinding machinery, systems and services.

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EIRICH has core expertise in processes and techniques used for the preparation of free-flowing materials, slurry and sludge. The main fields of application for such technologies include, e.g. ceramic and refractory materials, foundries, building materials such as concrete and plaster, battery pastes, fertilizers, glass and the processing of ores. Close co-operation between our own test centers around the world and collaboration with the research and academic community enables the "hidden champion" to provide solutions for innovative, cost-efficient products and processes. The family-managed company was founded in 1863 and operates from twelve locations on five continents.