



Case Study

## It's all about the Mix - Mixing and Granulation of Sinter Material in the Steel Industry

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With regard to abrasiveness sinter raw materials in the iron and steel industry are among the most demanding when it comes to mixing processes, especially, as these have to be performed continuously on a 24/7 basis.

(From the archive of "[bulk solids handling](#)", article published in Vol. 35 (2015) No. 3 , ©2015 bulk-online.com) Sinter is a base material in the production of iron and steel. Its quality is determinative for the following deoxidation and smelting process. The mixing and granulation of sinter material is a heavy duty application that makes specific demands on mixing technology: Large quantities of extremely abrasive materials have to be processed daily. The example of [Gebr. Lödige Maschinenbau GmbH](#) shows how a high mixing quality, extreme wear protection and particularly high ease of maintenance can be realised on a large scale. The company has produced the largest intensive mixer in its 75 years of company history for use in an Indian steel plant: the KM 57000 SIN. This huge machine, measuring eleven metres in length and weighing 60 tonnes, has been equipped by the experts in mixing and granulation from Paderborn to the highest standards.

**Sinter Material**

Iron sinter is required for producing pig iron in a blast furnace. The raw materials for sintering consist of iron ore, limestone, coke, return fines and binder. The various materials are fed in the correct ratios to the mixer from the respective storage bunkers, and are mixed and granulated before they are ignited in the ignition hood of the sinter strand. The material is subsequently transported on by the sinter strand while the sintering process continues to burn down through the sinter bed. The quality of the raw sinter mix achieved in the mixer and the granularity of the mix are very important as they, in addition to parameters such as the water content of the mix and the bed depth, determine the gas permeability of the sinter bed. Correct homogeneity and grain size distribution of the raw sinter mix improve the permeability of the mix and allow the sinter strand to travel at an increased speed, resulting in higher productivity. Mixing and pelletizing drums are used as standard in sinter plants. Due to the simple design – the material is moved by the slow rotation of the drum – these machines are low maintenance, which is an advantage when processing abrasive materials. However the mixing quality and granularity of the mix that can be achieved with this technology are limited. Intensive mixers and granulators are an economical alternative to the conventional mixing and pelletizing drums because they can meet the requirements of the industry. On the one hand, they can be used for processing a wide range of raw materials that have different grain size distributions. The KM 57000 SIN is able to process, for example, ore dust, pellet feed and also the very abrasive return fines produced during crushing and screening of the finished iron sinter. On the other hand, the use of intensive mixers makes it possible to save considerably on the amount of binder and solid fuel required, which increases the efficiency of the plant. The mixer achieves an excellent homogeneity and granularity of the mixture, which increases the capacity of the sinter plant.

### **Machine with inner Qualities**

Mixers in this area are designed for high throughput levels to meet the high demand of the steelworks for iron sinter. The intensive mixer features a drum volume of 57 000 litres and can process more than 1350 tonnes of raw sinter mix per hour. The rotation of the mixing tools creates a mechanical fluidised bed. Binding agent and water are added to the primary particles in the fluidised bed and distributed homogeneously throughout the material by the mixing unit. The intensive mixing process causes the primary particles to agglomerate to form granules. This process takes place around the clock as the supply to the blast furnace has to be guaranteed at all times. When designing the mixer, particular attention was paid to protecting the machine against wear and ensuring ease of

maintenance. The design engineers were able to utilise their extensive experience gained over many years in the development of intensive mixers for iron ore pelletizing plants. The entire surface of the mixing shovels of the KM 57000 SIN are hard-faced with tungsten carbide for heavy duty use in the steelworks. The underside of the drum is lined with high strength rubber. In addition to protecting against wear, this lining also serves to reduce the accretion of material on the wall of the drum, thus reducing the vibrations of the mixer. The drum itself was designed in two parts to allow fast and easy replacement of the shovels, shaft and rubber lining. This is a real challenge given the scale of the machine. A crane is required for opening the lid of the eight meter long drum. The already existing crane at the steelworks can be used for this. The advantage of this solution speaks for itself: The inside of the machine is perfectly accessible. To make it even easier to exchange the shovels, they can be moved at low speed into the desired position. The two-part mixing drum also offers another important advantage: The entire mixing unit shaft with its tools fitted can be removed within a short time in a single working shift. Thanks to the special drum design it is possible to achieve planned downtimes of less than two weeks per year. During operation, hydraulic drives on both ends ensure that the mixer is continuously moving. The KM 57000 SIN is a customised machine specially tailored to the customer's requirements. It took a year from receipt of the order to delivery of the machine. During this time, many of the 300 employees at the manufacturers headquarters in Paderborn were involved in the process. The machine was finally ready for delivery at the beginning of February 2015 and was sent by flat bed trailer to Hamburg. From there the mixer was shipped to India and has now arrived at its final destination.

## **Conclusion**

The mixing and granulation technology for the production of iron sinter in the steel industry has to overcome particular challenges due to the extremely abrasive materials and high throughputs. Although conventional systems used for production are low-maintenance, they cannot achieve the required quality of mixture and grain size distribution. In particular, they cannot be used for processing materials such as ultrafine iron ore and pellet feeds. Therefore intensive mixers and granulators provide an attractive alternative as they achieve an excellent mixing quality and optimum permeability, thus increasing the efficiency, productivity and profitability of the sinter plant. Gebr. Lödige developed the KM 57000 SIN as a solution for this heavy duty application. The largest mixer ever produced in the history of the company stands out for its wear protection and ease of maintenance: Thanks to its two-part design the eight metre long

drum of the mixer can be opened to allow optimum accessibility to the interior of the mixer.

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