



Product News

Lödige: Application-specific Ploughshare Mixer for Lithium Battery Masses

Edited by on 1. Feb. 2019

The processing of the required raw materials for the production of lithium batteries is subject to exacting quality requirements – up to the limits of technical feasibility. For example, the contamination of cathode masses by foreign ions, in particular iron, must be prevented at all costs. Lödige has addressed this challenging process-technical task with a special version of the proven Ploughshare mixer.

Electromobility is currently a frequent topic of discussion, and against a background of legal restrictions for diesel engines the focus is increasingly shifting to electrically powered vehicles. China, for example, has already specified a quota for electric automobiles of 10 % of all newly registered vehicles for 2019. This ambitious goal will require the production of enormous quantities of lithium batteries that can be realized only by way of a huge expansion of existing plant capacities. The demand is also increasing in Europe.

Processing of Raw Materials in Battery Production

In the long production chain for lithium batteries the processing of raw materials is a first, but decisive step for ensuring the quality of the final product. The cathodes of common lithium batteries today consist for the main part of a mixture of lithium carbonate and mixed nickel-cobalt-manganese oxide, to which additives have been introduced. On the other hand, some other materials should by no

means come into contact with the mass, as even small amounts can have a negative influence on the properties of the battery itself. Iron is one of these undesirable substances. Lödige has now developed a special machine type for homogenizing the cathode mass. Since even the slightest contamination caused by iron or steel abrasion must be prevented, this calls for elaborate protective measures for the steel mixer parts that come into contact with the product.

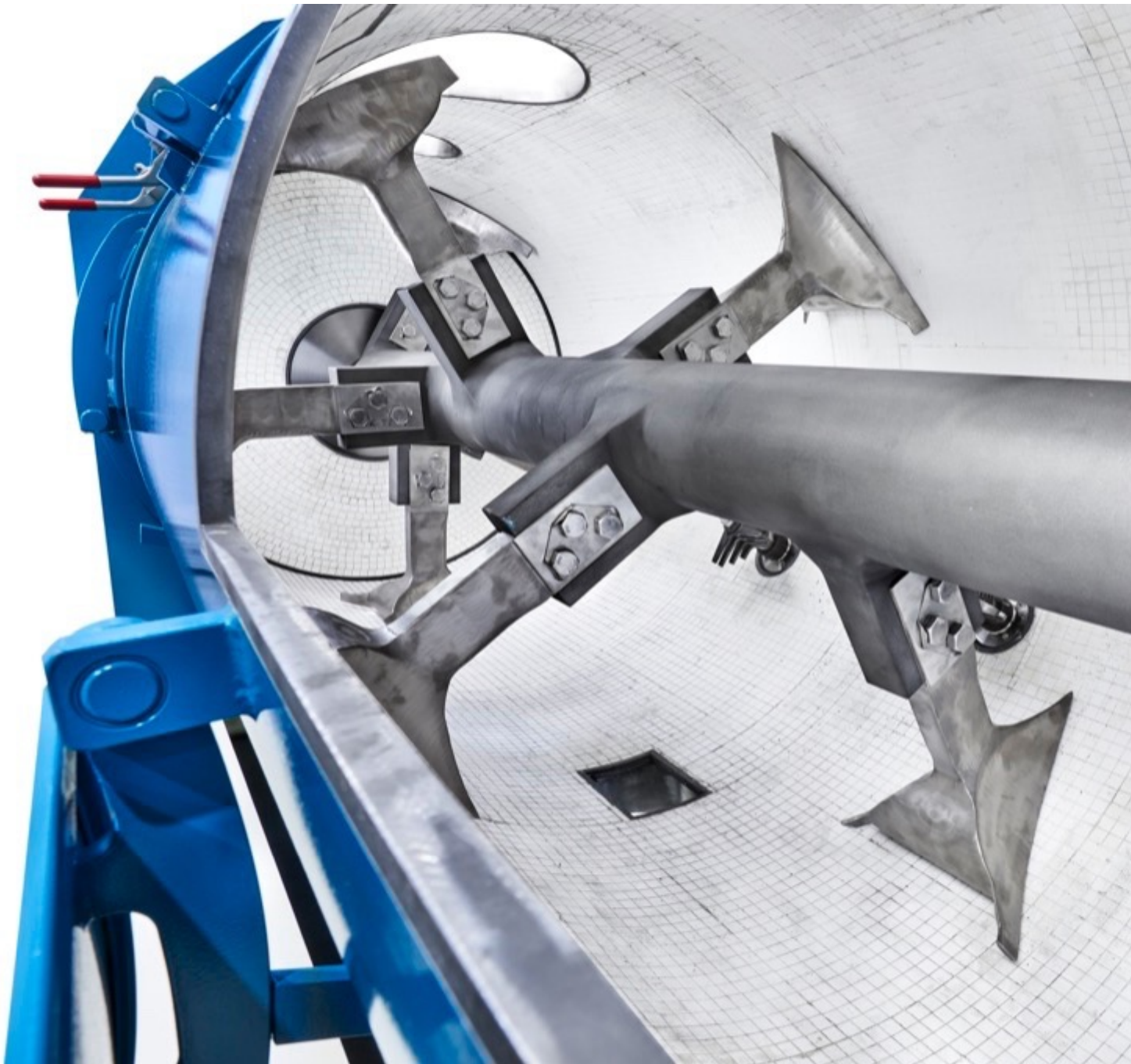


The processing of the required raw materials for the production of lithium batteries is subject to exacting quality requirements. Lödige has addressed this exacting process-technical task with a special version of the proven Ploughshare[®] mixer. (Source: Lödige)

This application-specific model is a further development of the Ploughshare[®] batch mixer. It functions according to the hurling and whirling process introduced by Lödige in industrial mixing technology that creates a mechanical fluidized bed.

Equipped with mixing tools that are specifically geared to the respective task, they deliver mixtures of the highest quality that can be reproduced at any time. Although Lödige builds the batch mixer specially modified for this application in a variety of sizes, the types with a mixing chamber volume of 1,200 to 3,000 litres have become established as a de facto standard. This is because they are optimally adjusted to the processing capacity of the up- and downstream process stages. Most manufacturers of lithium batteries and their chemical suppliers are located in eastern Asia. For this reason, Ploughshare® mixers in practical use in this area of application have hitherto been limited almost exclusively to the Asian region. However, the emerging needs of European car manufacturers will ensure that required production facilities are available in Europe.

Special Tile Lining



The mixer drum has a ceramic lining. The mixing elements, as well as the mixer shaft and choppers, are provided with a thin, but extremely rugged ceramic coating. (Source: Lödige)

The drum of the Ploughshare[®] mixer has a ceramic lining. The special tiles used for the purpose exhibit high mechanical stability and abrasion resistance. Due to their more complex geometry, the mixing elements cannot be covered with any random material, but require a thin and extremely rugged ceramic coating. This coating can be adjusted to the respective application. Common coating materials are aluminium oxide based. The coating is less than one millimetre thick, but

extremely tough and abrasion-resistant. Difficult contours can thus be completely and reliably coated. For some time now, coatings of hard metal alloys have been used as an alternative to oxide ceramics, which bear the risk of spalling. The latter offer an abrasion resistance that is comparable to ceramics, but are far less sensitive than the latter. In normal operation of a Ploughshare[®] mixer this difference is of little consequence, as the cathode masses to be mixed are introduced in powder form. Coarse particles that may damage the ceramic layers have been found to accidentally accumulate in the event of breakdowns or during maintenance work. In such cases, the hard metal coatings are considerably more robust and boost the operational reliability of the overall process. The more exacting quality requirements placed on the mixer in recent times – as taken into consideration in the ongoing optimization of Lödige solutions – are also evident elsewhere. Only a few years ago it was sufficient to cover or coat the main metallic surfaces that come into contact with the product, i. e. drum and mixing blades. Meanwhile other zones are being coated, e. g. the feeding inlets through which the product flows only once.

High-speed Cutting Heads

A special role in the mixers for battery masses is played by the choppers, i. e. the high-speed homogenizers in the lateral drum area. These are essential to achieve the homogeneity required for further processing the battery masses within acceptable times. The mixers employed here are equipped with up to four choppers. The choppers – operating at up to 3,000 revolutions per minute – are exposed to extreme stress. The cutting heads are therefore provided with highly resistant hard metal weldings or, at the customer's request, made completely of solid hard metal.



In the long production chain of lithium batteries the processing of the raw materials is a first but critical step in ensuring the quality of the final product. Today the cathodes of standard lithium batteries consist for the main part of a mixture of lithium carbonate and mixed nickel-cobalt-manganese oxide. (Source: Lödige)

Because the battery masses contain toxic and carcinogenic components, e. g. cobalt, uncontrolled spillage of the fine powdery substances must be strictly avoided. Here special attention should be given to the shaft seal that often proves to be a weak point. Although the stuffing box packings frequently used with mixers are less expensive to purchase, they do not satisfy the demand for a reliable and low-maintenance seal for this application. The use of state-of-the-art sealing systems adapted to the respective application conditions guarantees a seal that is superior to a classic stuffing box packing. As a rule, these are systems that are air purged or impinged upon with sealing air and contain several consecutive sealing ring pairs or rotating polymer seals.

Conclusion

The processing of the required raw materials in the production of lithium batteries is subject to exacting quality requirements. Lödige has addressed this demanding process-technical task with a special version of the proven Ploughshare[®] mixer, of which over 200 machines have been sold worldwide in the last five years. The latter achieves a homogeneous mixing of the cathode masses in the shortest possible time. This is essential for a consistent and reproducible quality of these high-tech materials.