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Manufacturers of lithium-ion batteries and supercaps rely on mixing technology from EIRICH

High-tech products such as lithium-ion batteries or supercaps have a complicated design and layout. During production, a large number of substances need to be mixed and prepared in such a way that the expected properties are achieved; in many cases, coating and dispersing processes also play an important role. Initial investigations in 2012 showed that the use of an EIRICH mixer offers a number of advantages. Several manufacturers of lithium-ion batteries and supercaps have now opted for mixing technology from EIRICH.

In many industries, mixing processes are simple because the raw ingredients have comparable bulk densities. However, things are different when it comes to manufacturing batteries and supercaps. Here, alongside active materials with, in some cases, relatively low bulk densities, including graphites or activated carbons, raw ingredients with very high bulk densities and densities, such as lithium cobalt(III) oxide, are also used. In addition, nanoparticulate conductive soots or oxides are also used that are much lighter than the other raw ingredients. In the mixing and dispersing process, this leads to system-related limitations if basic mixers like plowshare mixers or planetary mixers are used. It is known from relevant literature that simple mixers tend to cause demixing, particularly during dry mixing with extended mixing times, which means that the mixing process cannot be allowed to continue indefinitely. This makes it difficult to run the system to the point where optimum quality of the mix is achieved. In addition, the achievable shear rate is often not enough to fully disagglomerate the heavily agglomerated raw ingredients. In addition, during the production of coating mixes, after the dry mixing stage there are two further process steps – the addition of liquid and a dispersing process. For this purpose, the material needs to be transferred from the "simple mixer", such as a plowshare, into a suitable dispersing device, e.g. a dissolver, which is a complex process.

Investigations at universities and at customers have shown that EIRICH mixers, referred to in the present design as the EIRICH MixSolver[®], offer significant advantages here:

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Mixing and dispersing take place in the same unit, so there is no need for the transfer process after dry mixing.

What are the reasons for this? On conventional mixers and dissolvers, the tool is required to move the material and also to perform the actual process of mixing and dispersing/disagglomerating. By contrast, in the EIRICH MixSolver® a rotating pan takes care of moving the material, which means that the tool, which is arranged eccentrically in the pan, can be optimally designed for the mixing and dispersing process. The separation of material transport and the mixing/dispersing process also makes it possible to vary the speed of the tool within wide limits, and therefore also the energy input and shearing energy input into the mix, and to adapt it to the relevant mixing and dispersing task. As a result, with this unique system all viscosity ranges and consistencies from dry to plastic and beyond to suspensions can be processed. In many cases, this enables particularly cost-effective single-unit processes.

For many industries, this means that the dry premix of different raw ingredients and the dry dispersion can be prepared in the EIRICH mixer. Through addition of liquid, the plastic phase is started, in which the system uses a high energy input to coat, homogenize and disperse. With the addition of further liquid, the desired solids content or the desired viscosity can be adjusted. Both dispersions with low and high viscosities can be manufactured in a very short space of time, often less than 15 minutes; the preparation stage, which previously took hours, is thus reduced to just a few minutes; in many cases the previously required cooling of the mix can be omitted altogether.

Thanks to the special mixing principle of the EIRICH MixSolver®, it is also possible to do without the time-intensive process of pre-dissolving the powdery binder during the production of the coating mixes. The binder is simply added as a dry material together with the other dry raw ingredients at the start and not dissolved until the plastic phase after the liquid is added, without the tendency toward clumping that is otherwise common. As a result of this innovative single-unit process, the necessary plant engineering for production – and therefore the investment and operating costs – can be significantly reduced.

Hardheim, February 2017

EIRICH technology is used all around the world in many industries for mixing, granulating, coating, kneading and dispersing – all of which can be performed in the same, single machine. In sizes ranging from 1 liter up to 3000 liters, only a single mixing or dispersing tool is required. This means that the preparation system is excellently scalable to larger applications.

Further advantages are available when EVACMIX[®] vacuum technology is combined with this. During dry mixing, it often achieves a noticeably better dispersion of agglomerates; due to the omission of the air cushion, the energy input increases significantly, and shearing forces can be fed into the product with a much higher degree of efficiency. Kneading and dispersing under vacuum then ensures bubble-free suspensions, e.g. for subsequent coating processes. Of course, it is also possible to work under inert gas, or to use heating or cooling via the highly-efficient flash cooling system.

It should be noted here that, in the preparation of so-called lead acid pastes for the production of lead-acid starter batteries (e.g. for use in cars and trucks), the EIRICH mixer emerged as the standard worldwide after scientific investigations around 2000 showed that it could be used to achieve higher charging capacities and a longer service life for rechargeable batteries. Likewise, with lithium-ion batteries we see a significant improvement in performance parameters, such as electrochemical performance and the adhesive power of the coating. For this reason, it is safe to assume that the industry will continue to rely heavily on EIRICH technology in the future.

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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 applications for these processes are in the ceramics, refractory, foundry, construction materials, plaster, rechargeable battery, battery compound, fertilizer, glass and ore dressing industries. 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.