Karlsruhe Institute of Technology

Division I – Biology, Chemistry, and Process Engineering

Institute of Thermal Process Engineering (TVT) – Thin Film Technology (TFT)

FlexDie – Electrode Coatings for Battery Cells

A High-precision Intermittent Technology Increases the Production Speed

Electrode foils play a decisive role in the production of batteries and accumulators for electric cars, smartphones, and laptops. In the case of lithium-ion batteries, for example, the coating of electrodes ensures that lithium can be stored and released again. The electrode material is applied as a thin paste to a copper or aluminum foil. As yet, this foil coating process has been taking very much time and thus has been driving up manufacturing costs. Researchers at Karlsruhe Institute of Technology (KIT) now are able to significantly increase the production speed with the new intermittent, i.e. interrupting, process FlexDie (which is an acronym of "flexible die"). A special membrane is used which cyclically stops and restarts the application of the coating paste.

Precision Thanks to an Innovative Nozzle

Intermittent electrode patterns are already known from battery production: Between the coated sections, there is a strip of uncoated foil which serves as an electrical conductor. The scientists of the Thin Film Technology (TFT) research group of the Institute of Thermal Process Engineering (TVT) at KIT have developed a patent-pending process that accelerates the production of intermittent electrode foils while maintaining high precision. The start and stop edge gradient of the coating, which is crucial for the reliable functioning of the accumulators, has even been improved. The decisive trick is a newly developed nozzle equipped with a special membrane which is able to interrupt the coating

Inline measurement of the electrodes ensures highest quality.

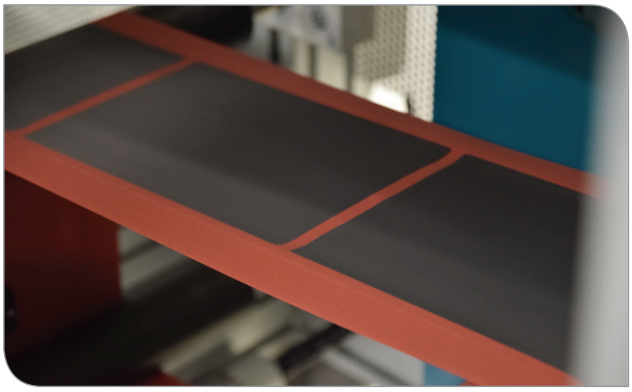
process abruptly, thus resulting in a precise stop edge even at high throughput speeds. The electrode quality is permanently monitored automatically, and process parameters can be adjusted, if necessary. This allows changes in production quality to be detected early on and ensures a consistently high product quality.

High Production Speed

In addition to doing without conventional nozzles, the process dispenses with other moving parts and thus enables very high frequencies in the production of up to 1,000 electrode patterns per minute. This makes it possible to increase the throughput speed. Instead of the 25 to 35 meters previously common in the industrial sector, more than 100 meters of coated film can now be produced per minute. It is possible to integrate the innovative coating process into existing plants as a drop-in solution as well as into production plants specially optimized for high production throughputs.

Use in Battery Cell Production

The combination of high process speed and excellent manufacturing quality makes it possible to achieve cost leadership in electrode production. The cost advantages provide battery cell manufacturers with competitive advantages in the highly competitive international market. As part of a spin-off from KIT, the technology, in conjunction with the specialized battery manufacturing know-how, is to be made available to mechanical and plant engineering as well as cell production companies. In addition to the hardware of the coating process, the portfolio includes optimized control and quality assurance functions as well as seamless integration into intelligent industrial Internet of Things infrastructures.



Battery materials applied intermittently over a large area

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