

Laser-based drying of lithium-ion battery electrodes

The energy transition has increased the demand for energy storage systems, thus making modern and energy-efficient manufacturing processes for energy storage systems necessary. By contrast, conventional drying is an energy-intensive process step in the production of lithium-ion batteries (LIBs). It is normally carried out in long continuous furnaces, which currently still use 92 percent fossil gas and take up a lot of space. Not only can laser radiation be used for drying and reduce the energy and space requirements, but the laser beam sources can be operated with renewable energies, which reduces dependence on fossil fuels.

Laser-based roll-to-roll process

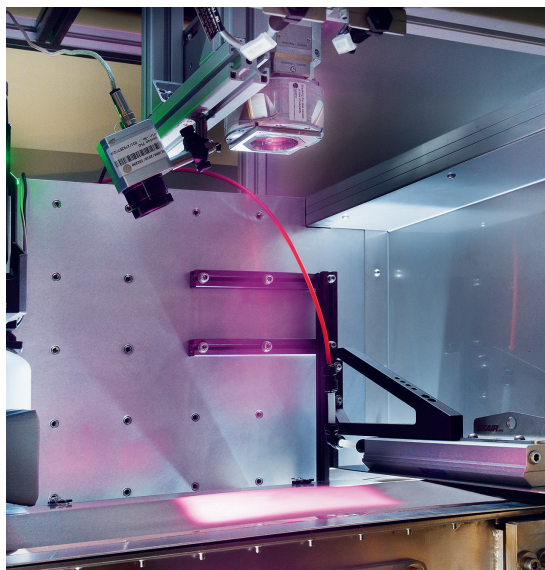
Fraunhofer ILT is developing a laser-based drying process for water-based battery electrode layers. In a roll-to-roll system, copper foils are coated with anode slurries through slot nozzles and dried using laser radiation. Peak temperatures above 160 °C must be avoided to prevent damage to the approx. 80 to 100 µm thin anode. Area-irradiating diode lasers are used to enable a large throughput in the roll-to-roll process.

Efficient drying with laser radiation saves energy and space

When laser radiation is used to efficiently dry LIB anodes, energy requirements can be lowered by up to 50 percent. The required drying distance can be reduced by at least 60 percent according to the results obtained so far. The components contained in the anode are not damaged by the laser radiation and suitable process monitoring. The anodes produced in this way have the same properties as anodes dried by conventional process. The institute is currently using a specially developed extraction concept, adapted process control and appropriate process understanding to further increase the belt speeds to industrially relevant orders of magnitude and to combine them with downstream laser structuring processes.

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*1 Roll-to-roll system for the production of battery electrodes in the Battery Lab of Fraunhofer ILT.
2 Laser drying module with adapted processing optics.*