The prospects of laser battery cutting electrodes

Can laser cutting improve battery performance?
This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 License. Laser processes for cutting,annealing,structuring,and printing of battery materials have a great potentialin order to minimize the fabrication costs and to increase the electrochemical performance and operational lifetime of lithium-ion cells.

How fast does a laser cut electrode?
Laser cutting of electrodes requires laser scanning speeds of 1-4 m s -1,an average laser power of 200-400 W,and laser repetition rates of up to 20-50 MHz [71,72]to cut 1-2 large areal electrodes suitable for pouch cell geometries per second. This type of high-speed cutting is necessary due to the electrode coating speed (25-50 m min -1).

How a laser-engineering structured electrode can improve battery performance?
With the electrode fabricated by laser ablation or modification,the 3D and high aspect ratio battery was completed. The laser-engineering structured electrode provides a significant improvement of cycle retention,and an increased power density and energy density on cell level could be achieved.

Can laser cutting of electrode materials be used for lithium ion cells?
Summary and Future Work The presented work discussed experiments of laser cutting of electrode materials for the production of lithium ion cells. The experiments focused on the cutting edge quality. The cutting edge quality was investigated by evaluating the geometrical parameters in macroscopic cross sections.

Can a laser cut a lithium ion battery?
High speed laser cuttings of electrodes for the lithium-ion battery using single mode fiber lasers have also been investigated by Patwa et al. . They illustrated the achievable highest cutting speed, the effect of the focus beam and the number of cutting passes.

Can remote laser cutting be used for lithium-ion batteries?
Investigating underlying physical phenomena with numerical analysis provides significant advantages to fully utilize the remote laser cutting of electrodes for lithium-ion batteries.In this paper,a mathematical model of three-dimensional self-consistent remote laser cutting is presented for anode (graphite-coated copper) of lithium-ion batteries.

This work investigates the quality aspects of laser cutting of Li-ion electrodes when a green fibre laser source (? = 532 nm, ? = 1 ns) is used rather than the more traditional infrared (IR) fibre laser source (? = 1,064 nm, ? = 250 ns). The processing conditions were investigated to reveal the technological feasibility zones. Clearance width was studied within ...

The laser cutting electrode technology not only reduces the loss rate of electrode materials but also achieves efficient and environmentally friendly electrode cutting in a low-carbon manner. The excellent structures produced by laser precision fabrication enhance not only the structural ...

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Nanophotonics. Laser processes for cutting, annealing, structuring, and printing of battery materials have a great potential in order to minimize the fabrication costs and to increase the electrochemical performance and operational lifetime of lithium-ion cells.

Laser cutting of battery electrodes is one such technology, where the non-contact nature of pulsed laser irradiation avoids costs and technical difficulties associated with tool wear in mechanical blanking [5]. Previous studies have shown that pulsed laser cutting can result in lower costs than those associated with mechanical blanking after as little as two years of high ...

This paper presents investigations on the influence of a laser cutting process on the cutting edge quality of copper and aluminum based electrode materials. The different ...

Within this programme the cutting of electrodes for Li-Ion cells by lasers is an issue, too. This paper provides a comparative study on cutting materials relevant for Li-Ion cells with beam...

In this work, the laser cutting of electrodes as one of the core processes in large-format battery production is addressed. A comprehensive literature review on the boundary conditions and the relevant quality characteristics of the separation process is presented.

This paper explores remote laser cutting techniques for anode electrode materials in battery cells for e-mobility usage, assessing high brilliance laser performance in different operational modes and setups.

Lithium iron phosphate battery electrodes are subject to continuous-wave and pulsed laser irradiation with laser specifications systematically varied over twelve discrete parameter groups. Analysis of the resulting cuts and incisions with an optical profiler and scanning electron microscope gives insight into the dominant physical phenomena influencing laser ...

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This paper presents investigations on the influence of a laser cutting process on the cutting edge quality of copper and aluminum based electrode materials. The different process parameters are examined and the main influencing factors on the quality are determined to ensure an optimized processing rate.

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The ultrashort laser system equipped with burst mode capability can be used to optimize the laser notching and cutting of electrodes in the production line of LIBs. Haung et al. 35 conducted a study on the effects of burst mode on laser cutting productivity and quality of anode and Cu foil. The bursts consisted of ps pulses with short interval ...

Laser processes for cutting, annealing, structuring, and printing of battery materials have a great potential in order to minimize the fabrication costs and to increase the electrochemical performance and operational lifetime of lithium-ion cells.

In addition, the coating technology and the process development have a strong impact on the quality, the performance and the safety of the assembled battery cells. 3. Laser Cutting of the Electrodes Mechanical cutting processes, such as die cutting, are state of the art for tailoring of electrode foils. Drawbacks of these processes are the high ...

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