



LASER STRUCTURING IN ROLL-TO-ROLL PROCESS

Task

The roll-to-roll production process is ideal for the efficient processing of thin and flexible materials. As a result, cost-efficient products can be manufactured for a wide range of applications, as both inexpensive substrate materials and a highly productive process are used. In particular, products from polymer electronics can be manufactured this way. Since conventional structuring methods such as lithography can only be implemented to a limited extent in a roll-to-roll production chain, laser-based processes are used for the parallelized structuring of surfaces and for the galvanic separation of functional thin layers. The use of ultrashort pulsed laser radiation (USP) makes it possible to process nearly independent of the material as well as to significantly increase spatial resolution.

Method

By combining highly repeating USP laser radiation with tailor-made optical systems for beam shaping and parallelization, Fraunhofer ILT has integrated powerful process components into a roll-to-roll production system. Thanks to adapted ablation strategies as well as temporal and spatial energy modulation, the system can reach high process speeds and selective laser ablation of thin layers on metallic and polymer substrates.

Results

Fraunhofer ILT has developed a system for the continuous, laser-based structuring of semiconducting layers in the field of thin-film photovoltaics. The implemented optical system allows a parallelized, selective material ablation with a continuous feed of the tape material. In addition to sensory monitoring the tape to be processed in conjunction with the use of galvanometer scanners, the system can also process geometrically flexible contours as well as incorporate process monitoring and control. The combination of parallelization and process control enables high-precision material processing at high throughput rates.

Applications

The know-how gained from thin-film photovoltaics can be transferred to the production of flexible OLED displays, solid-state batteries, electronic circuits as well as RFID and sensor applications.

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1 *Organic solar cell with laser-structured electrodes.*

2 *Parallelized inline structuring.*