

# Thin film materials processing with High-Power Diode Lasers

**LIMO**  
Lissotschenko Mikrooptik

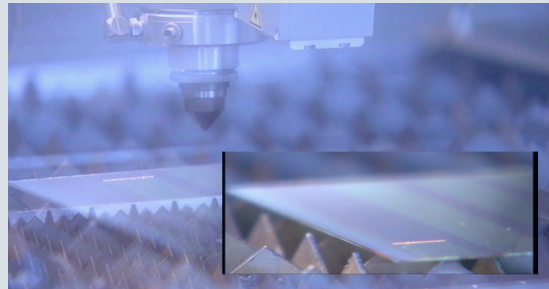
*Semiconductor • Electronics • Solar • RFID • Displays*

## **ELECTRONICS ON GLASS – Large Scale Parallel Processing Tools**

### **For Industry and related R&D and Engineering Organizations**

#### **Economical Aspects – The Directors View**

- higher margin by
  - higher production throughput
  - reduced cost per product
  - reduced logistics cost
- protection of the investment by compatibility with future production requirements
- reduced time to market
- secure technical leadership
- enhanced reputation



Dr. Fritz Falk, IPHT, Germany:

*„With LIMO technology we were able to get in our photovoltaic applications 50% higher current with the multi-crystalline Silicon thin film solar cells. For the first time we demonstrated an error free production of this new cell type. With this result we have opened the doors for an industrial use of this highly efficient solar cell.“*

#### **Economical Aspects – The Engineering Managers View**

- shorter tact time per panel by long line beam laser sources
- longer machine up-time by maintenance free laser systems
- long line beams enable parallel processing of large panels
- lowest cost of operation by 30% wall plug efficiency of the laser system
- integration in every infrastructure by compact foot print
- compatible with in-line processes
- no cooling period for the panel due to cold process

Dr. Gudrun Andrä, IPHT, Germany:

*„Thanks to the LIMO support, we got excellent results with our tightly scheduled tests and attracted the attention of technology and industry experts. LIMO delivered the best tailored solution for our research activities.“*

#### **Economical Aspects – The Production Team Leaders View**

- longer machine up-time by maintenance free laser systems
- shorter tact time per panel by long line beam laser sources
- turn-key implementation and integration
- ease-of-use

*„Immediately after system installation, we were able to work in a productive way to meet our targeted time and cost corridors. The LIMO training was compact and concise. After finishing it, we were able to run the system independently and did successful test series (IPHT)“.*

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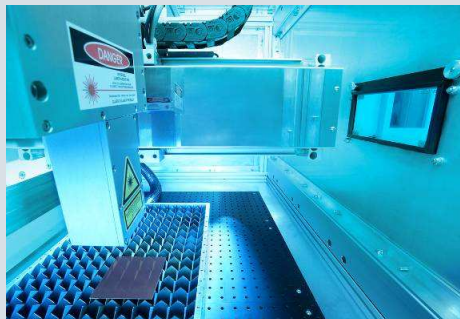
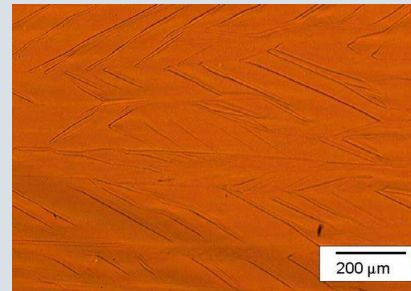
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## ELECTRONICS ON GLASS – Large Scale Parallel Processing Tools

### Technical Aspects

- higher electron mobility for active matrix displays and thin film solar cells
- lower sheet resistance for thinnest TCO layers
- thermal processing of single and multilayer coatings
- fastest processing by up to 100kW/cm<sup>2</sup> power density
- crystallisation free of cracks
- diode lasers with highest brightness and excellent power stability ensure fast processing and very good repeatability
- brightness up to 1 x 10<sup>8</sup> W/cm<sup>2</sup> x rad<sup>2</sup> available
- high efficiency due to use of micro-optics
- best application results by
  - excellent homogeneity about the scalable line length
  - high brightness
  - flexible spatial intensity profile over the full line length possible
  - flexible temporal distribution of intensity over the full line length possible
- in-line process control compatible
- well-defined heat affected zone: processing of defined areas

Example of crystallization of a 500nm a- Si film	
laser system	free beam diode laser system with 350 W
material	500 nm a-Si
output power	350 W
speed	50 mm/s
line length	12 mm x 0.1 mm



Example of SnO TCO tempering	
laser system	free beam diode laser system with 450 W
material	100 nm SnO: Al
output power	450 W
speed	100 mm/s
line length	12 mm x 0.1 mm

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# Thin film materials processing with High- Power Diode Lasers

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## **New Process Development Tool for Rapid Thermal Processing of Thin Film for Solar Cells, Semiconductor Wafers and Coated Float Glass**

Based on the unique L<sup>3</sup> - LIMO Line Laser technology with process optimized beam shapes, the new system is optimized for annealing, crystallization and tempering of thin films on glass or semiconductor wafer with scan & repeat processes. The system is designed for process development and optimization of new thin films for solar cells, semiconductor devices and other coatings on glass. Higher transmission, lower resistance and higher solar cell efficiency of the thin film layers were already demonstrated. In addition, these line lasers can be used for rapid thermal inspection and quality assurance as well.

The system can be equipped, e.g., with 450 W to 950 W laser sources that run in a cw or pulsed mode with a power density of up to 100 kW/cm<sup>2</sup> and a typical line beam geometry of 12 mm x 0.1 mm. Together with 3 linear stages move the beam across the target with up to 1 m/s velocity. To transfer the process into production systems the laser sources can be scaled up to several meters line length for optimized productivity and profit.

For further information please refer to [www.limo.de](http://www.limo.de) or contact Dipl.-Ing. Dirk Hauschild, [d.hauschild@limo.de](mailto:d.hauschild@limo.de).



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