

Beam Shaping Excellence



Activation and Optimization of Material Properties with Light

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HISTORY
1998

 LIMO's refractive micro-optics enable materials processing with **direct diode lasers**

2001

 LIMO beam shaping optics enable **high resolution lithography**
2007

 First VIS Activation Line based on LIMO's **beam transformation technology**
ACTIVATION LINE

Enabling new material properties

2012

 First UV-L100 Activation Line for the Lift-off process in **OLED production**
2016

 Acquired by **Focuslight** Ltd., China

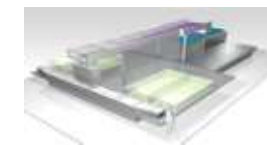
1999

First LIMO diode laser system

2004

 First beam shaping systems
 Opening of the **Applications & Process Development Center**

2011

 Pilot laser system for large-area scalable **finishing of surfaces and coatings**

2015

 First UV-L650 Activation Line for the Lift-off process in **OLED mass production**
2017

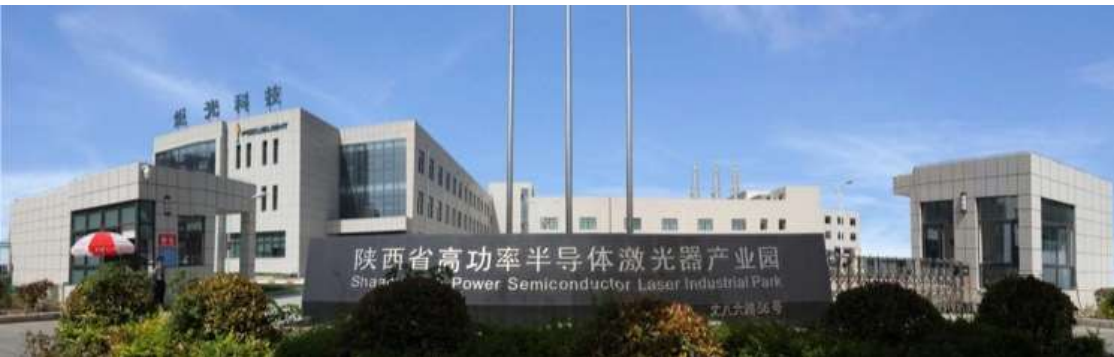
 First **UV-L750** for OLED mass production

1992

 Foundation and start of **micro-optics production**

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KEY FIGURES LOCATIONS



350 Employees
30% CAGR
Open package & FC
Industry
Medical
Scientific

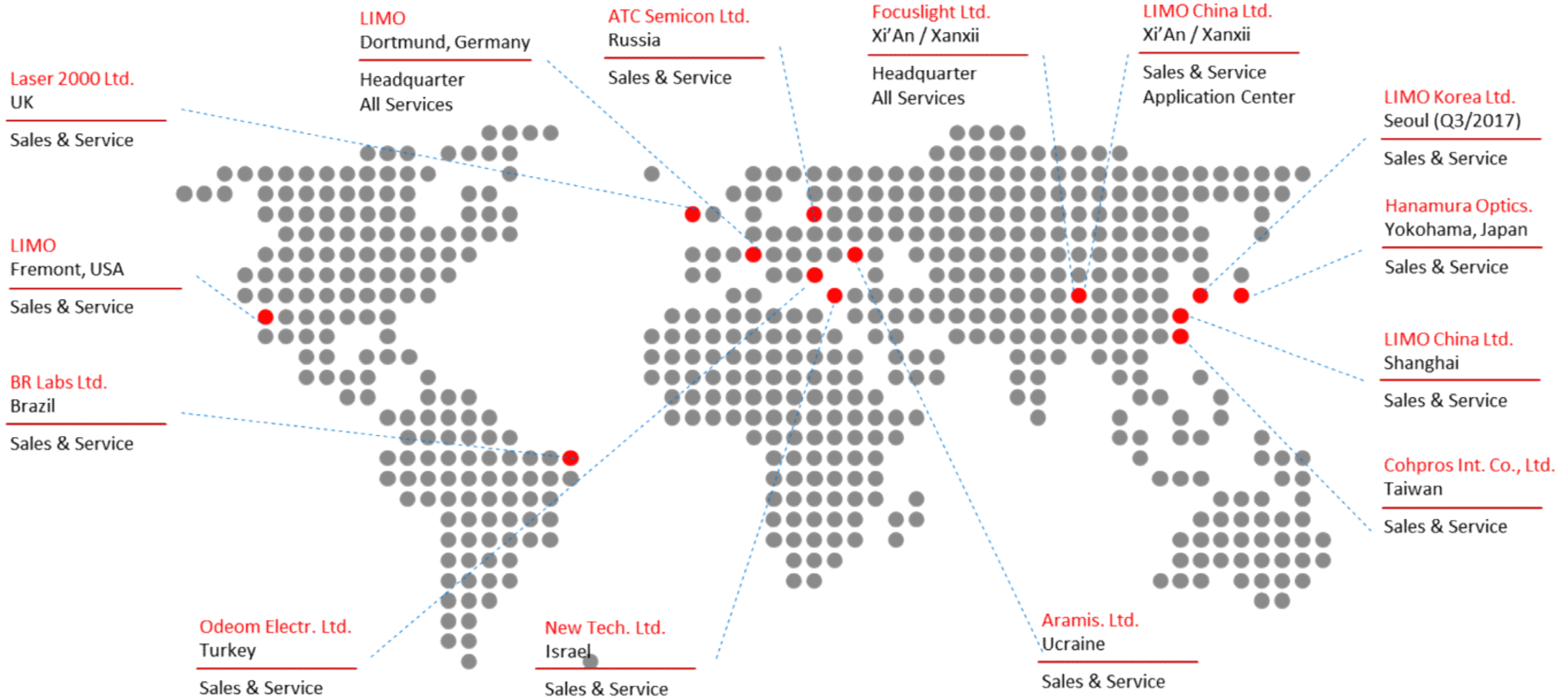


198 Employees
REV'16 18M€
Micro-optics
Laser systems
Optical systems



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KEY FIGURES LOCATIONS



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OVERVIEW MICRO-OPTICS LASER SYSTEMS OPTICAL SYSTEMS



MICRO-OPTICS

FA / SA collimators
Homogenization
Spot to line or area / to flat top
2D freeform / 3D freeform is coming

LASER SYSTEMS

100...2000mm+ line systems 100...600 μ m
Power levels 10kW...100kW+
Closed loop pyrometer controlled welding
Welding, annealing & dopant activation

OPTICAL SYSTEMS

100...750mm LA, 30 μ m SA width
up to 1200W UV power @120mJ, 10kHz
Top hat Gaussian or super Gaussian
Infrared, green, UV
Flat-panel displays, photovoltaics and metal

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MICRO-OPTICS

Any glass materials / 2D freeform
FA / SA collimators
Beam transformation
Homogenization
Spot to line / spot to area
Gauss to top hat
(Micro-) optical assemblies
3D freeform is coming

Wafer size up to 300mm x 350mm!



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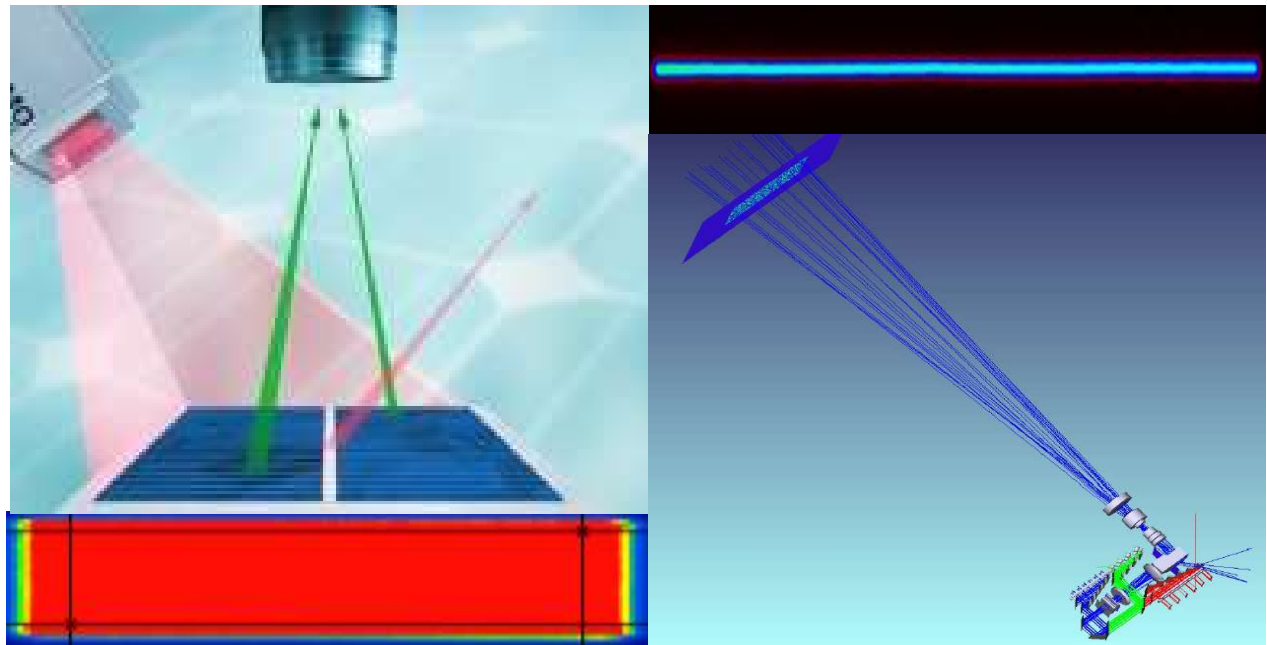
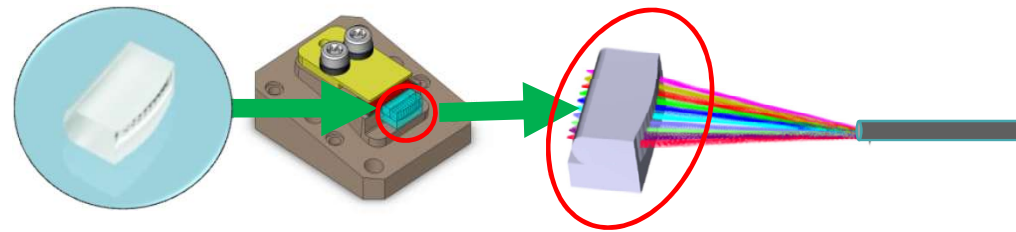
LIGHT SOURCES

From mW to multi kW

Diode Laser UV – IR
High Power Diode Laser VIS - IR
Single Emitter, Bars, Stacks

LED
LED Matrix

Fiber Laser
DPSSL
Excimer Laser
CO₂

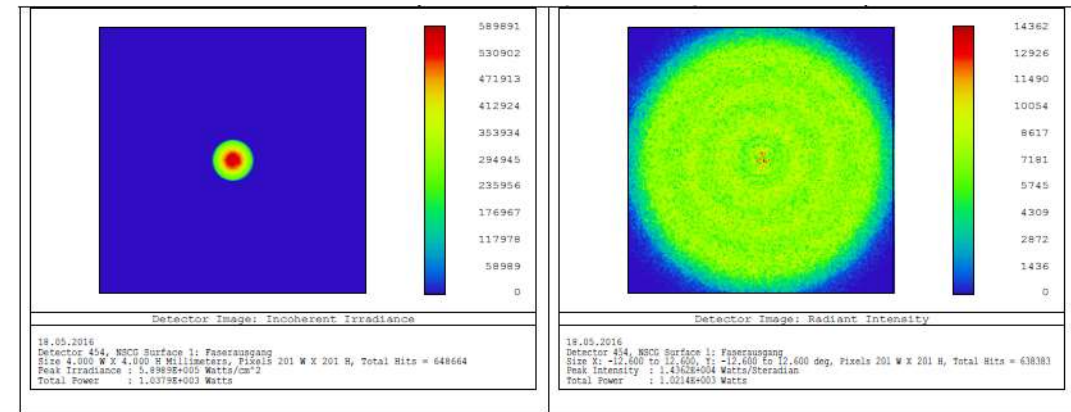


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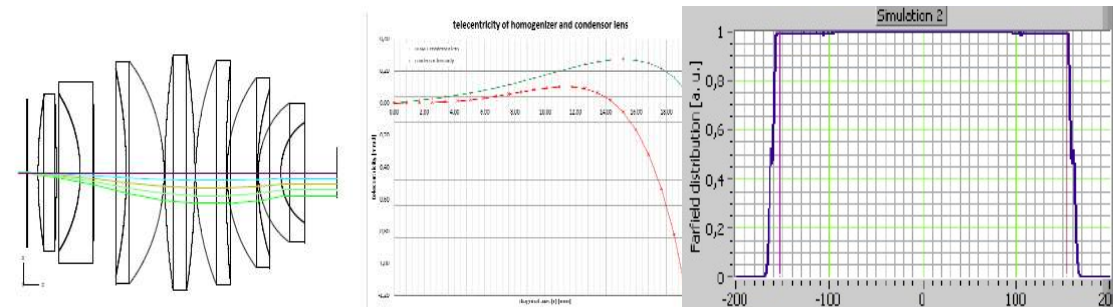
OPTICAL DESIGN TOOLS

- Zemax
- VirtualLab
- Code V (test), Solstis
- In-house programmed wave optical software



APPLICATIONS

- Full wavefront performance simulation
- Tolerance analysis
- Contract design studies



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LASER SYSTEMS

Spot and line systems

0.1...50mm

20...500W

Closed loop pyrometer control

Process development

Annealing

Dopant activation



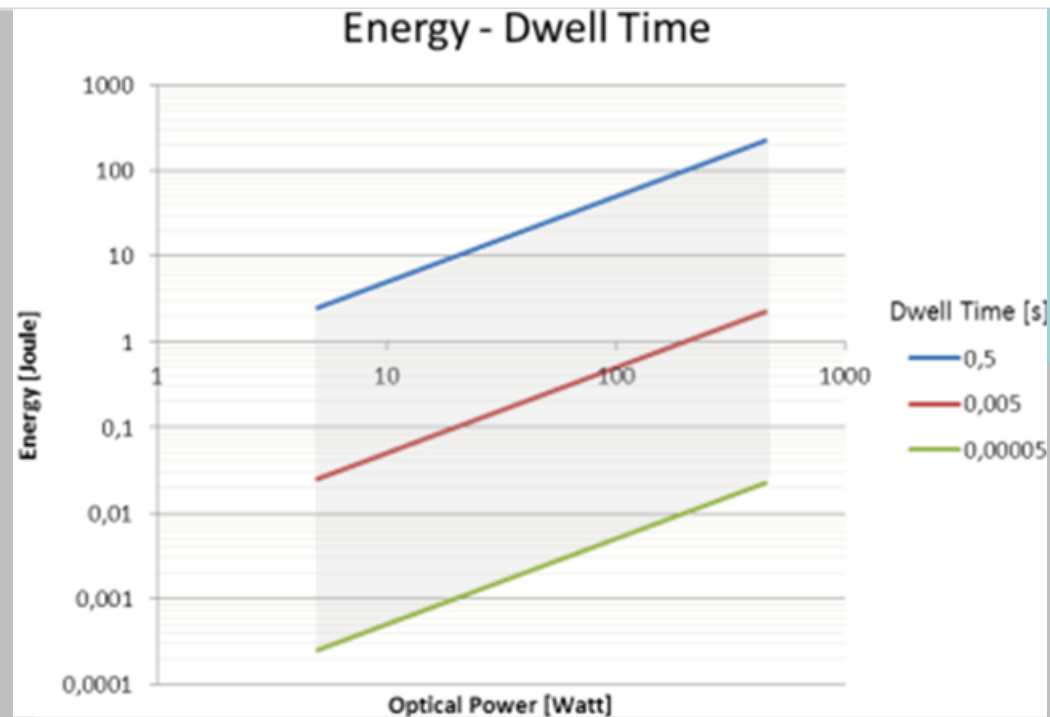
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IR LINES

Sintering
 Defect Annealing
 Activation of Charge Carrier
 Optimization of Charge Carrier Density
 LPC - liquid phase crystallization
 SPC – solid phase crystallization
 RTP – rapid thermal processing
 LTP – laser thermal processing
 RTA – rapid thermal annealing
 RTD – rapid thermal drying
 LAMO – laser assisted material optimization
 LAMS – laser assisted material synthesis



**6 MAGNITUDES OF
 NUMERIC CONTROLLED
 PROCESSING ENERGY
 WITH ONE SYSTEM!**

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OPTICAL SYSTEMS

100...750mm line length, $\lambda < 800\text{nm}$ (UV/ VIS)

300mm... ∞ line length, $\lambda > 800\text{nm}$ (IR)

30...600 μm beam width

>100KW infrared power

1200W UV power @120mJ, 10kHz

Top hat, Gaussian or super Gaussian

Infrared, **green**, **UV**

Flat-panel display lift-off and annealing

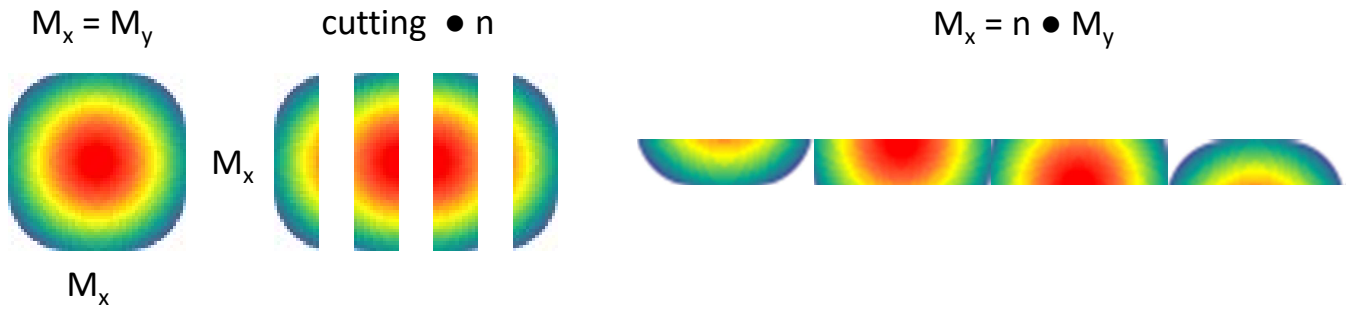
Photovoltaics

Metal



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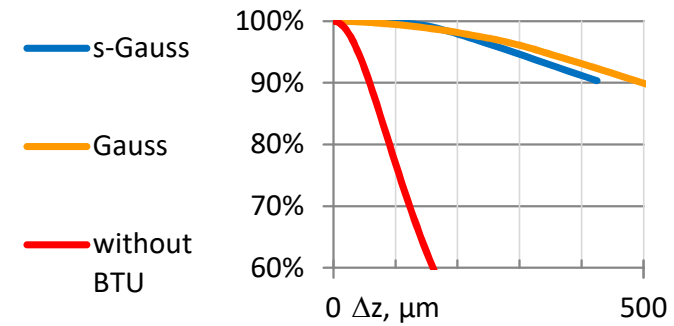
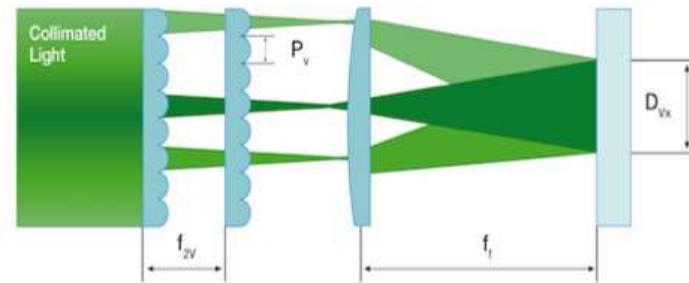


USE OF LIMO
BEAM TRANSFORMER

For generating highly anisotropic beam shapes with unmatched focal depth

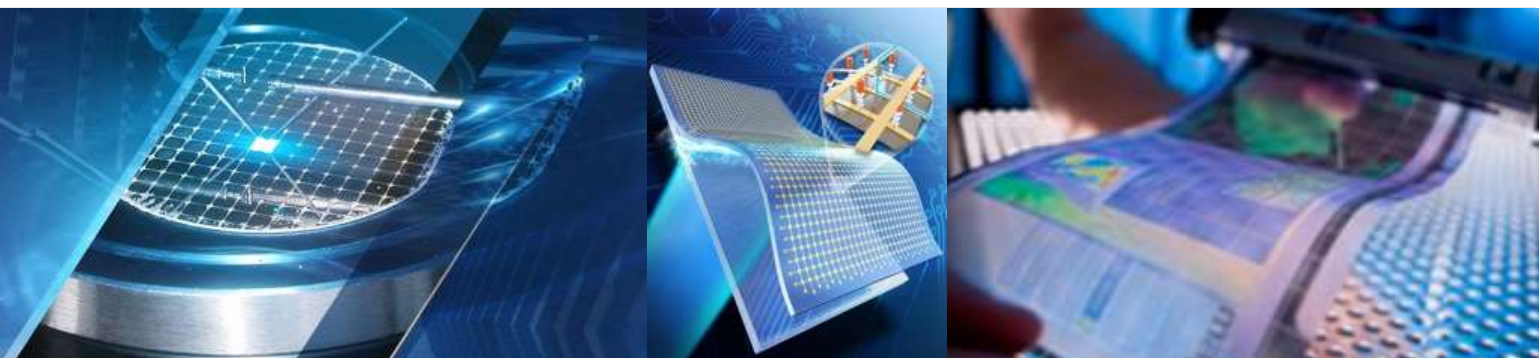
AND MICRO-OPTICAL
ARRAYS

For homogenization better than 1%



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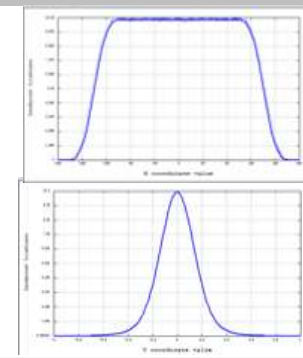
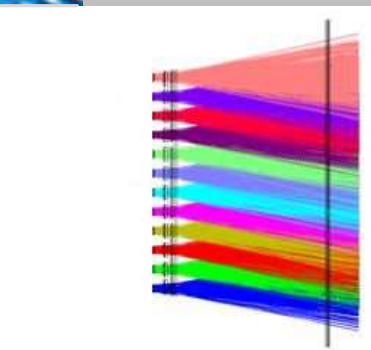


UV & GREEN LINES

Laser lift-off
Thin silicon wafer
Flexible electronics
Flexible displays

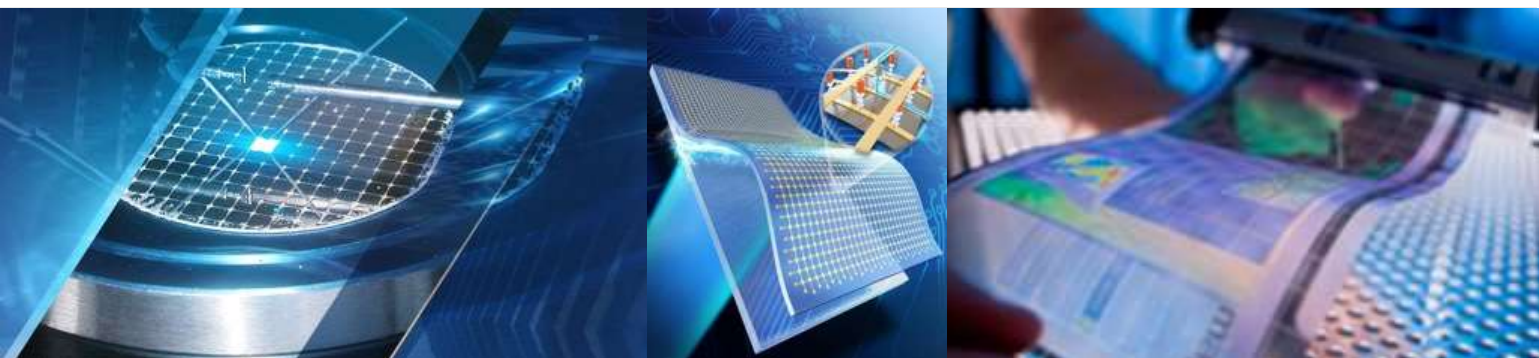
IR LINES

Solar cells
Liquid phase crystallization
Annealing
Hardening, alloying



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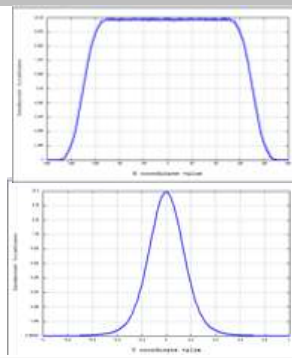
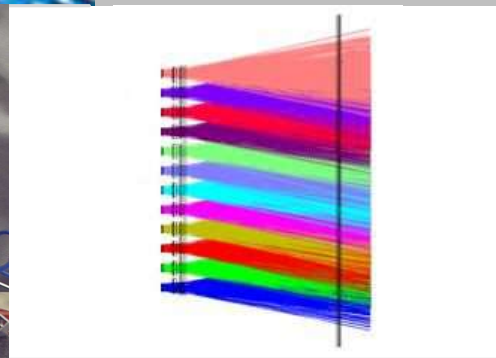
OVERVIEW MICRO-OPTICS LASER SYSTEMS **OPTICAL SYSTEMS**



UV & GREEN LINES

Laser lift-off
Thin silicon wafer
Flexible electronics
Flexible displays

IR LINES
Solar cells
Liquid phase crystallization
Annealing
Hardening, alloying





We look forward to a successful cooperation!