

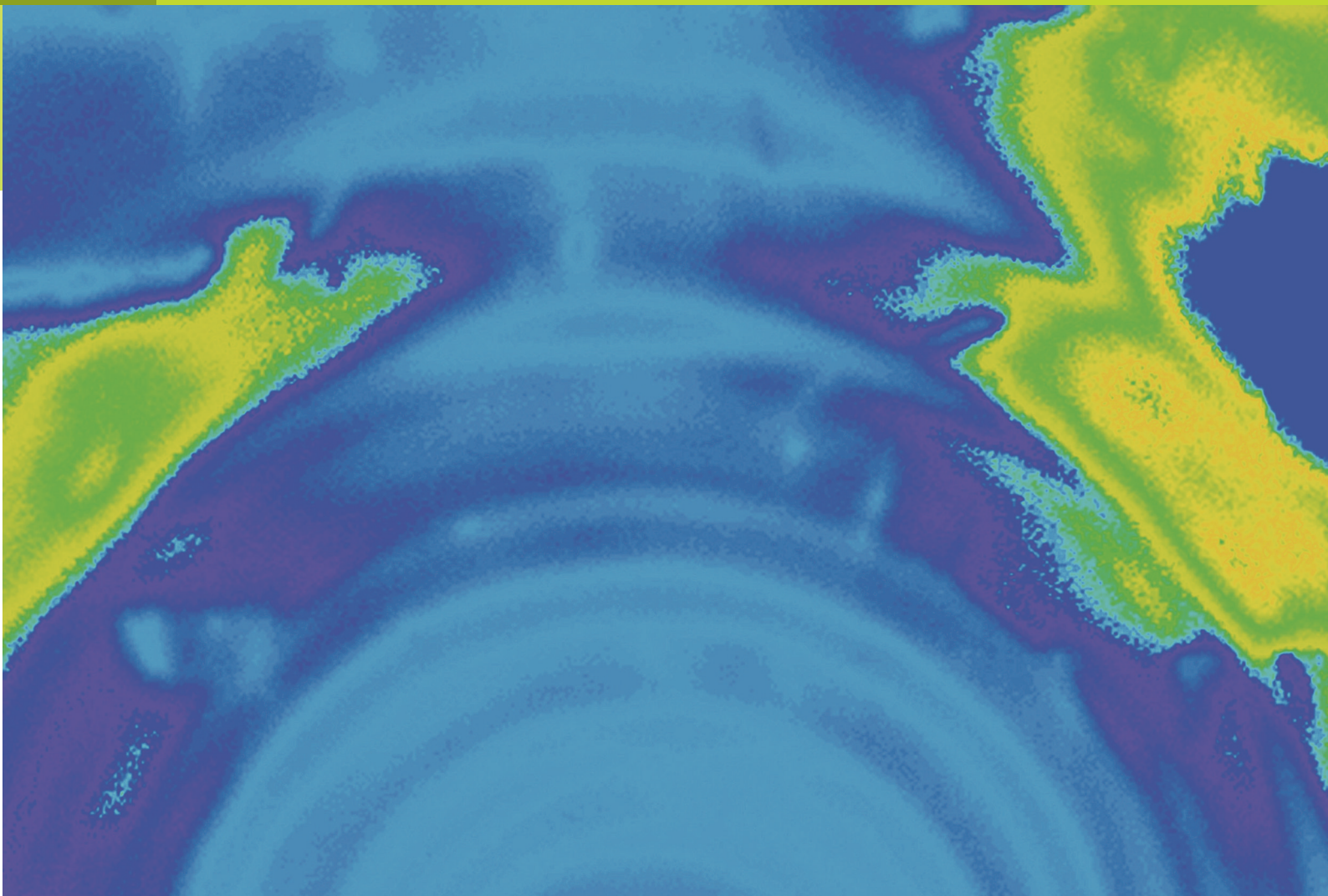
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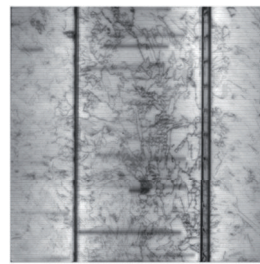
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LumiSolarCell System

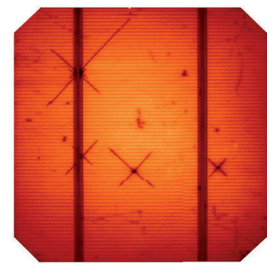
Photoluminescence (PL), Electroluminescence (EL), and Thermography (IR) Inspection of Photovoltaic Cells and Wafers



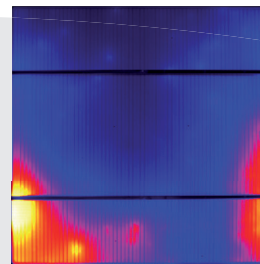
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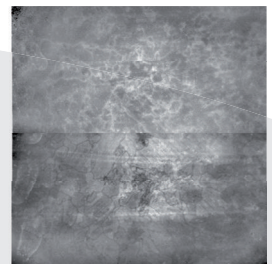
EL Imaging



PL Imaging



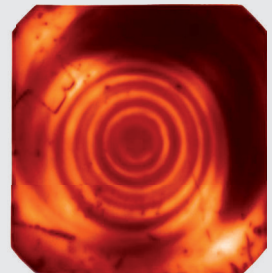
Thermography



As-cut Inspection



Rs Mapping



Wafer Imaging

The award-winning¹⁾ LumiSolarCell System utilizes the photoluminescence, electroluminescence, and infrared phenomena to image micro cracks, shunts, regions of low lifetime, inhomogeneities, hot spots or other cell failures of photovoltaic cells or wafers. EL, PL and IR as contactless and therefore non-destructive methods are an indispensable tool for advanced solar research. The knowledge gained will lead to increased product quality and yield.



Compared to other PL systems LumiSolarCell provides a unique approach to the world of PL inspection: instead of a laser, an innovative HighPower LED light source is utilized for excitation of the substrates. As a benefit of this development, LumiSolarCell is a compact, safe, and low-maintenance device. Furthermore it is scalable in terms of intensity and supported cell sizes.

Due to the outstanding sensitivity of the whole set-up, multiple PV technologies such as Si-based cells and wafers as well as thin film mini modules can be measured.

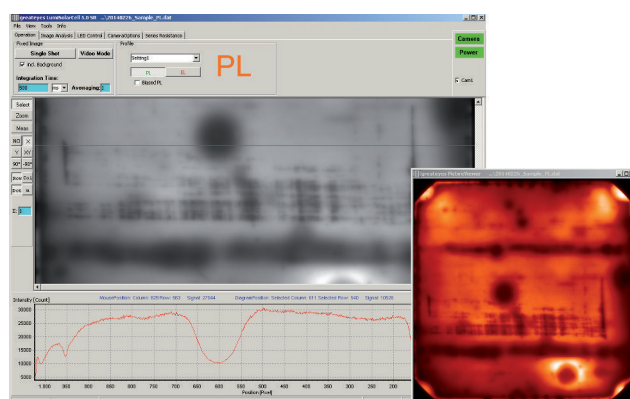
LumiSolarCell is delivered as a turnkey system. Different versions of the system are available (off-line, automated batch system, OEM in-line, pure PL or EL, combined EL/PL, or EL/PL/IR).

Key specifications

Functionalities	EL, Reverse bias EL, PL, biased PL, Series resistance, (Lock-in) Thermography, Lifetime
PL light source	HighPower LED array Adjustable intensity, max. 1500W/m ² (>1 Sun) Homogeneity >90%
EL excitation source	Programmable power supply, 0-100V, 0-7.5A
EL contacting adapter	4-quadrant Power Supply (V+ ,V- , I+ ,I-), 0 to +/-20V, 0 to +/-10A Adapter for 5 and 6 inch cells (156mm x 156mm) included Flexible design for 2-5 bus bars Vacuum contact adapters for IBC cells available as an option
Image size	1024 x 1024 pixel, 16 bit or 2048 x 2048 pixel, 16 bit
Substrate size	max. 200mm x 200mm
Image resolution	150µm/pixel or 80µm/pixel
Typ. exposure times	0.1sec-10sec depending on the substrate and type of measurement
Power supply input	100-240V, 50/60Hz
Dimensions of housing	715mm x 600mm x 1120mm
Weight	~60kg

LumiSolarCell software

- Save, quicksave, load images
- Supported file formats: BMP, JPEG, TIFF, TXT and raw data
- Single image mode, video mode
- Automatic background subtraction
- False-color-representation of images
- Intensity slices in x, y direction
- Linear/logarithmic scaling
- Zoom functions/image viewer
- Remote Control of Module Power Supply



¹⁾ The LumiSolarCell system has been conferred with the Berlin Brandenburg Innovation Award.

Features of the LumiSolarCell system

Characterisation methods	Electroluminescence: EL and reverse-biased EL imaging, measurement of the local cell voltage, mapping of the local current density, series resistance measurement Photoluminescence: PL imaging, biased PL Minority carrier lifetime mapping Thermography (IR) Lock-in Thermography (LIT)
Inspection capabilities:	Micro-cracks identification Shunt detection Finger defects Paste properties Local lifetime Dead cells Broken cells Hot spots Inhomogeneities and impurities
Areas of application:	Inspection of wafers, processed solar cells and thin film substrates Research and development Characterization and qualification Failure analysis Identification/sorting of wafers & cells
Advantages of the system:	Non-contacting characterization through PL measurement Unique, award-winning HighPower LED light source Combined EL/PL/IR system in a compact table top device Outstanding image quality No limiting safety requirements in contrast to laser-based PL systems Industry proven all over the globe Cost over performance Scalable set-up
Successfully tested on various solar cell types:	Monocrystalline silicon (mono-Si) Polycrystalline silicon (poly-Si) Amorphous silicon (a-Si) Copper indium sulfide (CIS) Copper indium gallium selenide (CIGS) Cadmium telluride (CdTe) Heterojunction with intrinsic thin layer (HIT)

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