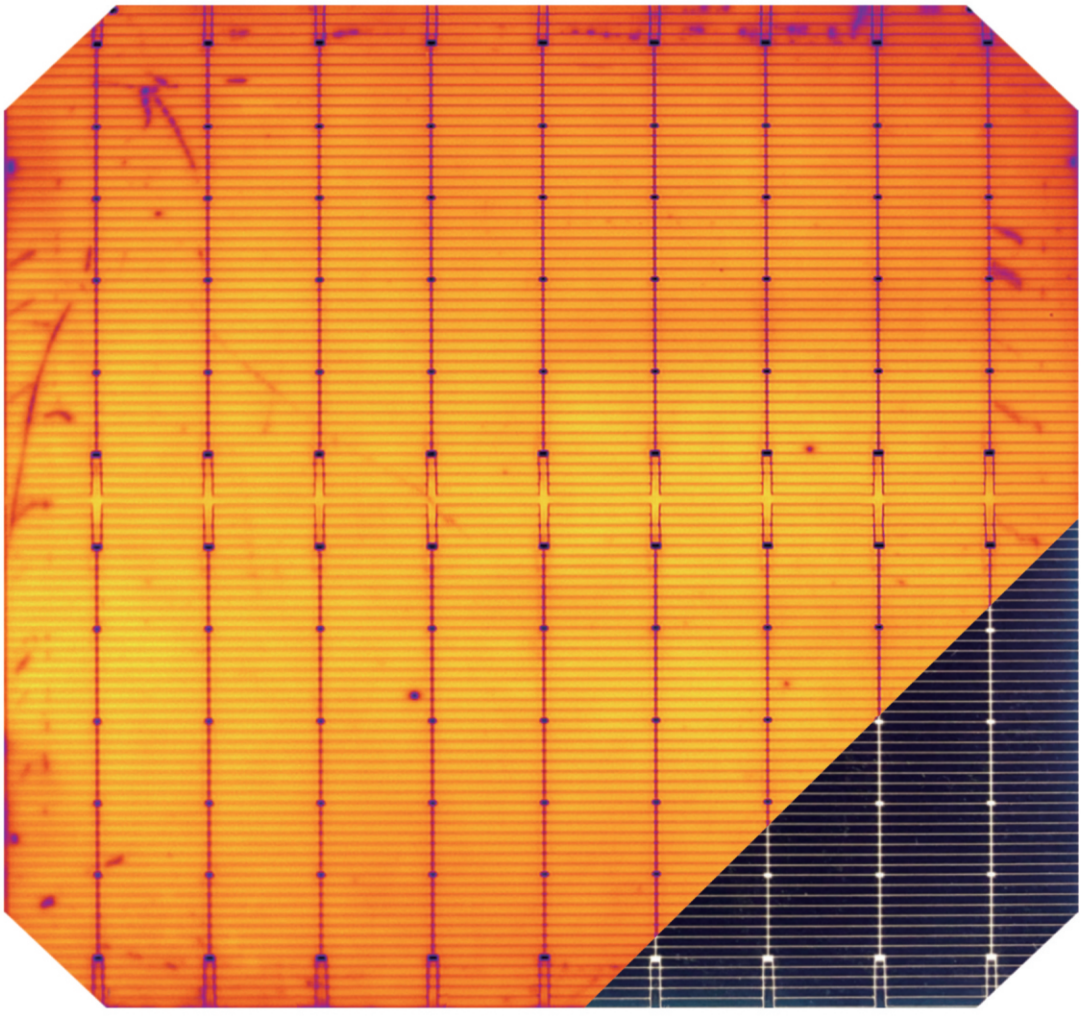
INNOVATE. CONTROL. YIELD.

PRODUCT CATALOGUE
2021 COLLECTION

Market leader for luminescence inspection in the PV industry



BT Imaging is the world's leading supplier of photoluminescence imaging technology for research laboratories and manufacturers of photovoltaic bricks,wafers,cells and modules.

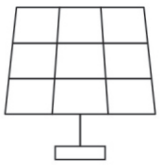
We provide state-of-the-art metrology hardware and software for measuring solar cell characteristics, yield and performance. We continue to work closely with our customers to develop new technologies and applications.



FOUNDED BY PROFESSOR THORSTEN TRUPKE & DR. ROBERT BARDOS, WORLD LEADERS IN PHOTOVOLTAIC CHARACTERISATION

UNSW
THE UNIVERSITY OF NEW SOUTH WALES

A SPIN OUT FROM THE UNIVERSITY OF NEW SOUTH WALES, 2008



LEADING EQUIPMENT SUPPLIER OF PHOTOLUMINESCENCE(PL) INSPECTION EQUIPMENT FOR SILICON PV MATERIALS



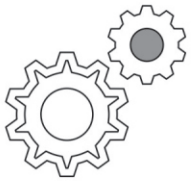
PL INSPECTION PIONEER FOR THE PV INDUSTRY, MARKET-LEADING ALGORITHMS & QUANTITATIVE IMAGE ANALYSIS



OVER 80 INVENTIONS AND INTERNATIONAL PATENTS ON PL & EL TECHNOLOGIES



TRUSTED BY OVER 70 LEADING COMPANIES, RESEARCH FACILITIES & UNIVERSITIES



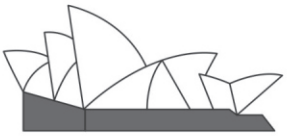
EXPERIENCED TECHNICAL SUPPORT TEAM OFFERING PROMPT & PROFESSIONAL SERVICE



HIGHLY TRAINED ENGINEERS FLUENT IN ENGLISH & MANDARIN



100% AUSTRALIAN MADE, SAFE, RELIABLE & EFFICIENT PRODUCTS



HEADQUARTERED IN SYDNEY, OPERATING GLOBALLY, INCLUDING OFFICES IN SHANGHAI, JIAXING & TAIPEI

Company Awards

William R. Cherry Award



Professor Thorsten Trupke, cofounder and Chief Technology Officer of BT Imaging, has been awarded the prestigious 2021 William R. Cherry award; considered to be one of the discipline's peak international awards.

Professor Trupke has been recognised for significant research outcomes and for his outstanding contribution to photovoltaic technology. His most impactful contribution to date has been the development of photoluminescence imaging for silicon wafers and solar cells. This principle and associated analysis methods have become standard tools used by researchers worldwide and used in PV production on a daily basis. Professor Trupke's work on the theoretical analysis and practical applications of silicon photoluminescence has resulted in significant gains in solar cell efficiency, and has become the foundation for the exponential growth in the global adoption of solar energy.

The purpose of this William R. Cherry award is to recognize an individual engineer or scientist, who has made significant contributions to the science and/or technology of PV energy conversion, with dissemination by substantial publications and presentations. The Prize is named after William R. Cherry, who is widely regarded as being the founder of the photovoltaic community.

Other Awards

Clunies Ross Innovation Award

BT Imaging founders, Professor Thorsten Trupke (left) and Dr. Robert Bardos(right), received the 2019 Clunies Ross Innovation Award. They are currently CTO and COO of the company. The Clunies Ross Award is one of Australia's most prestigious technology awards and is awarded by the Australian Academy of Technology and Engineering. The winners are among the most outstanding contributors in their respective fields of research.



Professor Thorsten Trupke (left) and Dr.Robert Bardos (right) received the 2019 Clunies Ross Innovation Award.

Energy Innovator Awards

BT Imaging was awarded "Best Photovoltaic Inspection Equipment Specialists 2019" by Corporate Vision magazine. Corporate Vision magazine selected the best companies in the global energy industry in 2019 for the "Energy Innovator Awards". Each individual award is specified according to the company's product and service.



LIS-R3

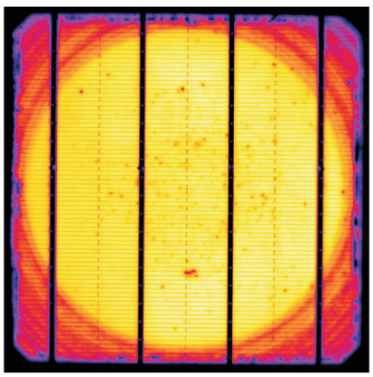
The “swiss army knife” for inspection in silicon PV

Multi-functional PL imaging tool for wafers, cells and mini-modules, ideal for R&D laboratories or for sampling in production

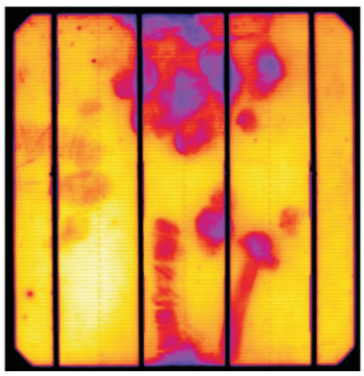
- Designed to meet the latest customer needs
- Proven reliability in 24/7 operation
- Eye-safe class 1 laser product
- Enlarged field of view in the latest version



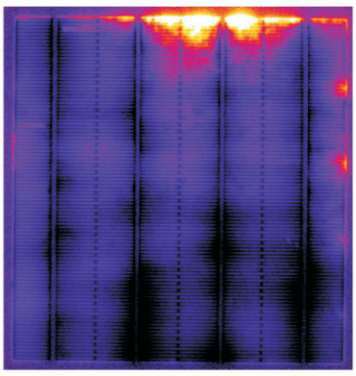
Function	As–cut Wafer	Half-processed Cell	Cell	Mini-module	Thick Mono Slug
PL imaging	✔	✔	✔	✔	✔
EL Imaging and Rs Imaging			Option	Option	
QSS-PC and Calibrated Lifetime		Option			
IV, Suns-Voc Curves			Option	Option	
Voc, Jmpp, Jo and Efficiency Images			Option	Option	
Front and Bulk Separation Estimation			Option	Option	
Muti-Si As-cut Wafer Analysis	Option				
Mono-Si As-cut Wafer Analysis	Option				
Thick Mono Slug Analysis					Option



PL image of a cell with dark rings



PL image of a contaminated cell



Rs image of a cell with firing issues

LIS-R3 Slug



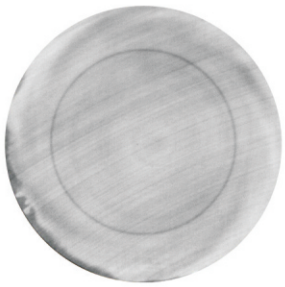
Advanced quality control workstation for mono ingots and wafers

PL imaging tool for inspection of mono slugs

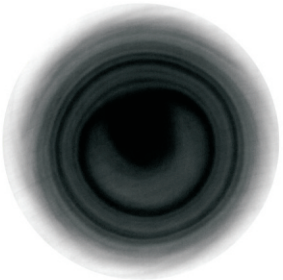
- Used for full inspection by Tier 1 CZ mono manufacturers
- No slug pre-treatments required
- Automatic slug classification
- Proven reliability in 24/7 operation
- As-cut wafer inspection also available
- Enlarged field of view in the latest version

Sample Type	• Thick mono slugs and mono Si as-cut wafers
Technology	• Area scan PL imaging
Key applications	• Grading of slugs • Mono ingot and wafer quality control • Mono ingot manufacturing process improvement
Functions	• PL imaging • Analysis metrics • Automatic slug classification
Value propositions	• Fast and reliable quality control • Effective assistance to human inspectors • Higher throughput for mono wafer manufacturers

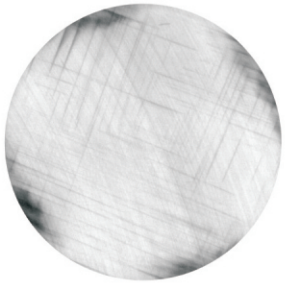
Slug with no defects



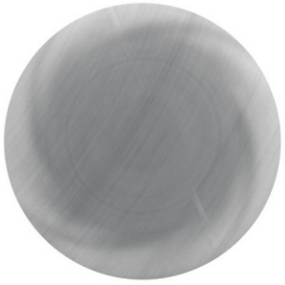
Slug with dark rings



Slug with dark rings and dark centre



Slug with slip lines

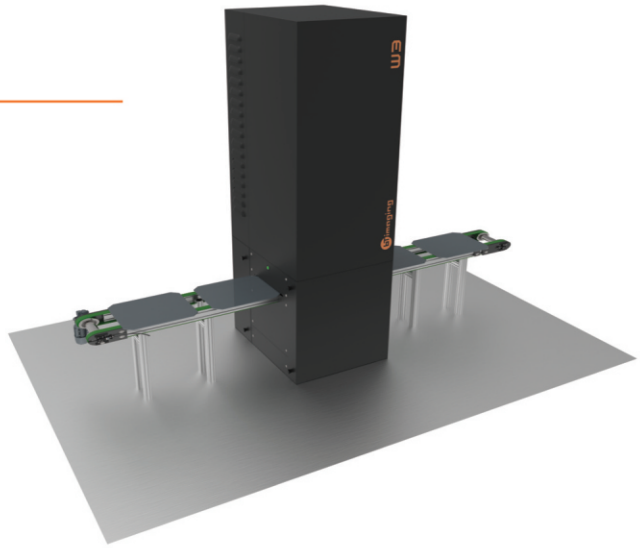


Slug with dark rings



Slug with dark edge

Qa-W3

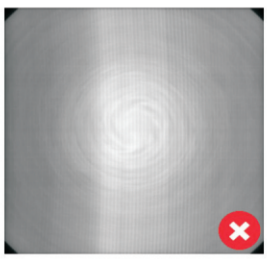


Quality control workstation for as-cut wafers, half-processed cells and finished cells

Laser-based PL imaging tool for quality control and sorting of as-cut wafers, half-processed cells and finished cells

- Measuring time: 1.8s per sample
- Market leading imaging and algorithm
- Enlarged field of view in the latest version

Sample Type	• Mono and multi Si as-cut wafers, half-processed cells and finished cell
Technology	• Line scan PL imaging, on-the-fly acquisition
Key applications	• Quality control • Cell production process optimization • Sample sorting and rejection • Inspection of wafer supply for cell manufacturers
Functions	• PL imaging • Analysis metrics (e.g. non-uniformity) • Sample sorting
Value propositions	• Prevent poor samples from going further • Proprietary metrics from automatic image processing • Customized sorting conditions • Automation configuration available for R&D and production
Integration method	• Standalone



Mono as-cut wafer with non-uniform cutting



Mono wafer after diffusion



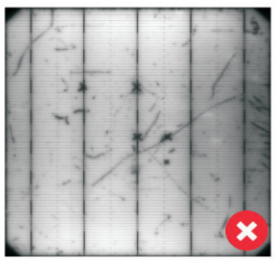
Mono wafer after PSG removal



Mono wafer after ALD

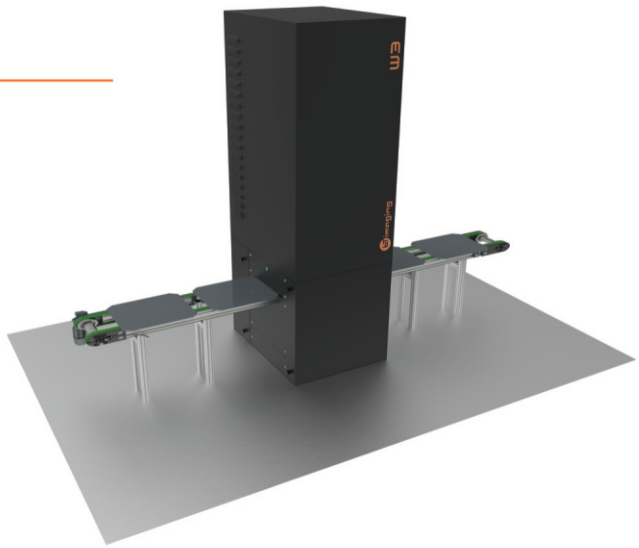


Mono wafer after annealing



Mono cell with scratches & cracks

iLS-W3

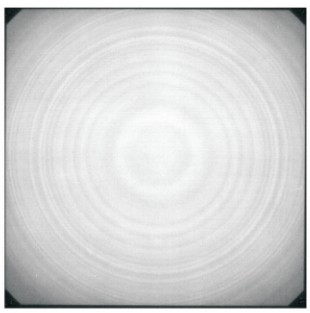


Wafer inspection at production line speed

PL imaging tool for quality control and sorting of as-cut wafer

- Contactless inspection and sorting
- Easy integration
- On-the-fly measurement with throughput 6,000 to 8,000 WPH
- Superior ability to detect ring defects in mono-Si as-cut wafer
- Proprietary algorithm
- Enlarged field of view in the latest version

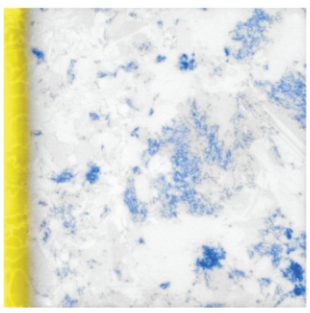
Sample Type	• Mono and multi Si as-cut wafers
Technology	• Line scan PL imaging, on-the-fly acquisition
Key applications	• Quality control • Brick/ingot production process optimization • Sample sorting and rejection • Inspection of wafer supply for cell manufacturers
Functions	• PL imaging and defect overlay • Analysis metrics • Sample sorting
Value propositions	• Wide range of customize metrics • Enables strategic wafer pricing • High throughput
Integration method	• Fully integrated



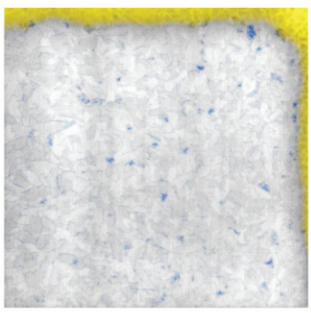
PL image of a mono DW as-cut wafer with ring defects



PL image of a multi DW as-cut wafer



Overlay of a multi slurry as-cut wafer



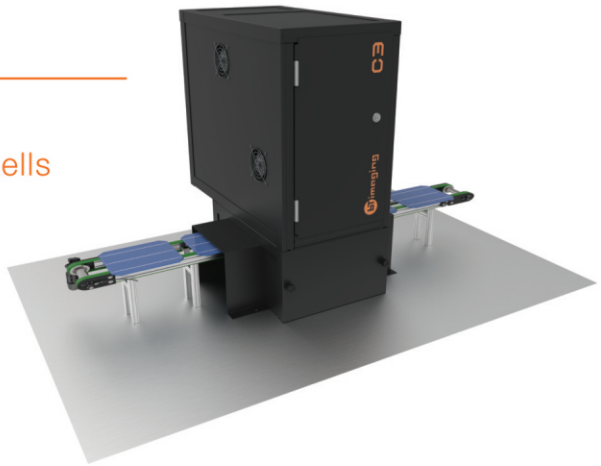
Overlay of a multi DW as-cut wafer

Overlay Legend:

Defects

High Impurity

iLS-C3 H



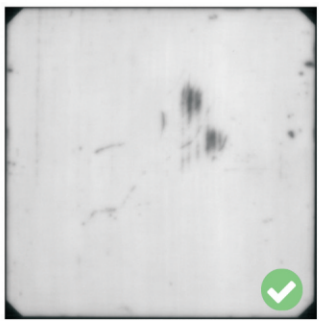
On-the-fly inspection of half-processed cells

LED-based PL imaging tool for quality control and sorting of half-processed cells

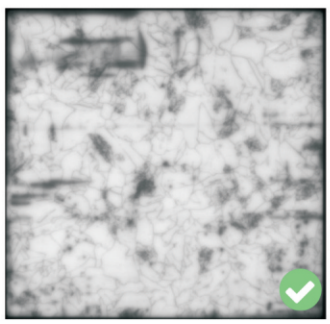
- Contactless inspection and sorting
- Easy integration
- Throughput 5,000-8,000 WPH
- Proprietary algorithm
- Enlarged field of view in the latest version

Sample Type	• Mono and multi Si half-processed cells
Technology	• Line scan PL imaging, on-the-fly acquisition
Key applications	• Quality control • Process optimization • Sample rejection
Functions	• PL imaging • Analysis metrics (e.g. non-uniformity) • Sample sorting
Value propositions	• Prevent poor samples from going further • Proprietary metric from automatic image processing • Customized sorting conditions • Automation configurations available for R&D and production
Integration method	• Fully integrated

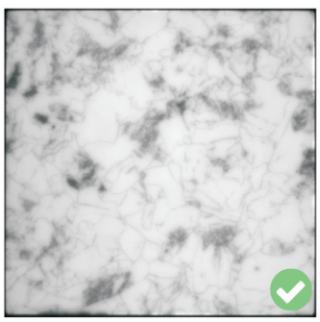
Sorting Examples



Mono wafer after PSG removal



Multi wafer after PSG removal



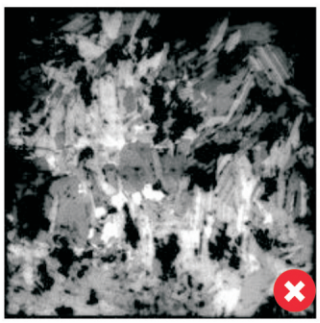
Multi wafer after PECVD



Mono wafer after aluminum oxide deposition



Mono wafer after amorphous Si deposition



Multi wafer after PECVD

LIS-B3



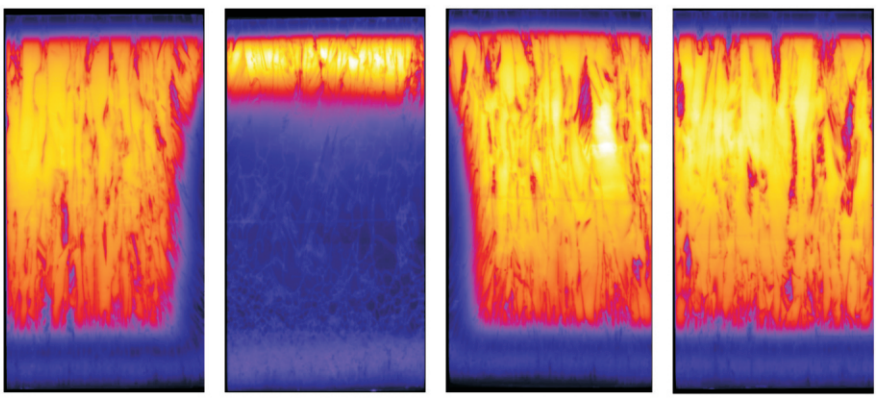
Detailed quality testing for bricks and ingots

PL imaging tool for R&D quality control and grading of silicon bricks and ingots

- Grading and cutting guide
- Bulk lifetime analysis
- Larger measurement range than effective lifetime
- Ideal for fast process feedback on ingot growth
- PL imaging on as-cut wafer also available

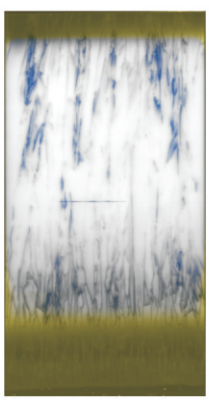
Sample Type	• Mono and multi Si bricks/ingots, as-cut wafers, half-processed cells and finished cells
Technology	• Line scan PL imaging
Key applications	• Quality control • Process optimization
Functions	• PL imaging and defect overlay (excl. half-processed and finished cells) • Bulk lifetime image (for ingots/bricks) • Cutting and grading guide (for ingot/bricks)
Value propositions	• Superior dynamic range compared to equipment reporting effective lifetime • Bulk lifetime becomes increasingly important for high-efficiency cells • Detailed bricks/ingot quality profile • Enables strategic wafer pricing

PL image examples of a multi-Si side brick



South surface | East surface | North surface | West surface

Color overlay example



Overlay Legend:
Defects
High Impurity

Color overlay highlights defects detected by automatic image processing

LIS-M1

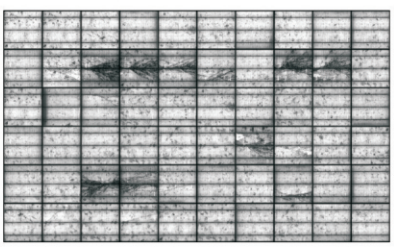
The new benchmark for luminescence inspection of PV modules



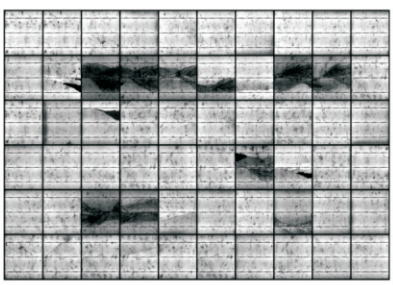
Premium PL imaging tool on full-area PV modules

- Proprietary line scan PL^+ imaging
- Unique and proprietary series resistance enhanced image analysis
- Exposes module defects not visible in EL images
- Unmatched image quality

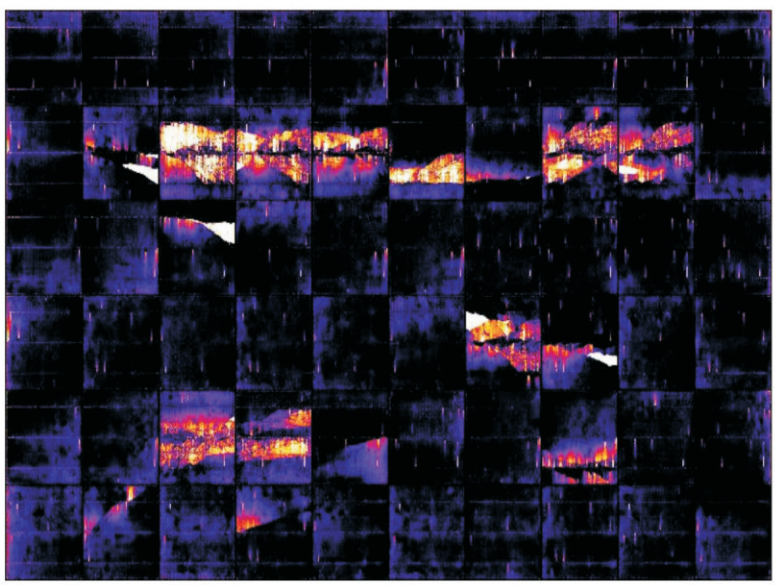
Sample Type	• Mono and multi Si modules
Specifications of sample	• Up to 2.3m x 1.15m module size • Supports half-cell and shingle modules • Adaptation to other cell types or materials on request
Technology	• Line scan EL and PL imaging
Key applications	• Module quality control • Module process optimization
Functions	• PL and EL images • Resistance-enhanced image
Value propositions	• Proprietary photoluminescence imaging technique • Quantitative degradation analysis • Suitable for R&D labs and on the factory floor



PL^+ image

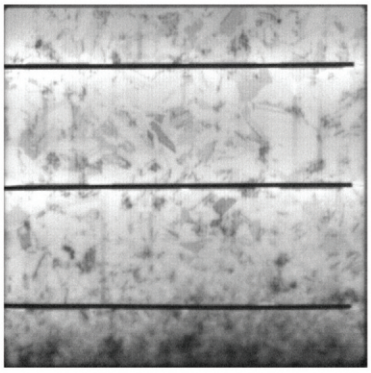


EL image

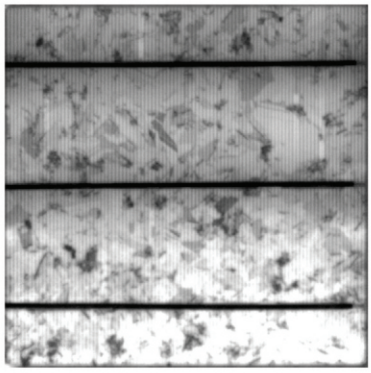


Resistance-enhanced image

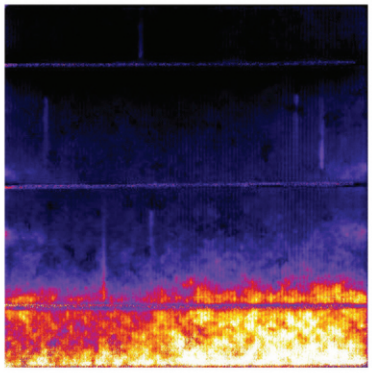
Unambiguous detection of series resistance defects that cannot be classified from EL images:



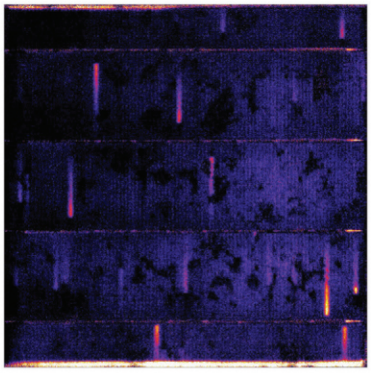
EL image



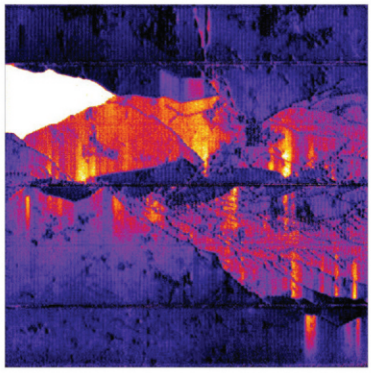
PL^{+} image



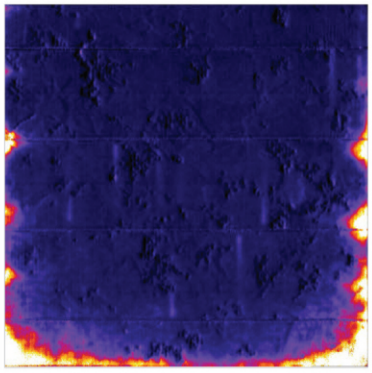
Resistance-enhanced image



Cell with broken fingers and edge isolation problems

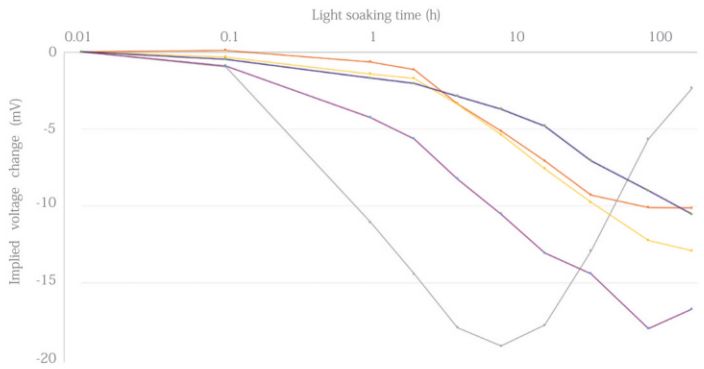


Cell with fully and partially isolated areas due to cracks

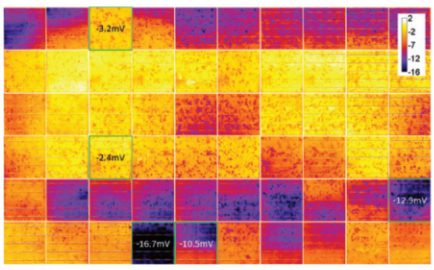


Wide range of resistance or contacting issues detectable

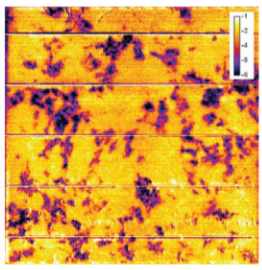
Quantitative loss analysis in degradation studies on fully assembled modules



Voltage degradation and recovery for each cell at different stages



Average voltage loss analysis on cell level (color scale shows voltage loss in mV)



Voltage loss analysis showing local variations in degradation dynamics (color scale shows voltage loss in mV)

Market leader for luminescence inspection in the PV industry

INNOVATE. CONTROL. YIELD.

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Tel: +61 2 9962 8861
Email: info@btimaging.com

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Email: chao.shen@btimaging.com
Tel: +86 1385 719 1657 (China)
+61 433 666 505 (Australia)