Challenges and Solutions for Anti LID Treatment

抗LID處理的挑戰和解決方案

Quality Roundtable at PV Taiwan
September 20th 2018, Taipeh

VisionX	CondensoX	Nexus	Securo	RDS	Protecto	RSS	Solar
Convection Soldering	Condensation Soldering	Contact Soldering	Tests | Trials	Drying | Hardening	Coating	Special Systems	Solar Equipment

Rehm Thermal Systems銳德熱力設備

Reflow Soldering Systems
Convection I Condensation

Selective Conformal Coating
Coating of PCB‘s

Special Systems
Customer specific systems

Drying Systems
Drying I Hardening

Solar Equipment
Drying I Sintering

Software solutions
For efficient production

Rehm – Worldwide 銳德 - 全球

Headquarter and Production Facilities總部和生產工廠

Blaubeuren, Germany布勞博伊倫，德國

Production Facilities生產工廠

Dongguan, China中國東莞

Solar Equipment – Overview太陽能設備-概述

Fast Firing Systems
燒結爐

RFS-D-250
RFS-D-500
Speedfire

Dryer
烘乾機

RDS 2100/460
RDS 3000/460
RDS Speed
RDS 12000 Magazine PV
RDS 11300/700

LID Regeneration Tools
LID再生工具

RRS-LID-SL
RRS-LID-DL

VOC Thermal Oxidizer
VOC焚燒塔

Oxidizer Size M
Oxidizer Size L

LID regeneration tool – Challenges 挑戰

BO related LID

- up to $\Delta\eta$ = -5%$_{rel}$
  高達$\Delta\eta$ = -5%rel
- within the first 24 hours
  在首個24小時之內
- depends on Boron and Oxygen concentration in Si
  取決於硼和氧的濃度
- Hydrogen need for regeneration
  再生需要氫

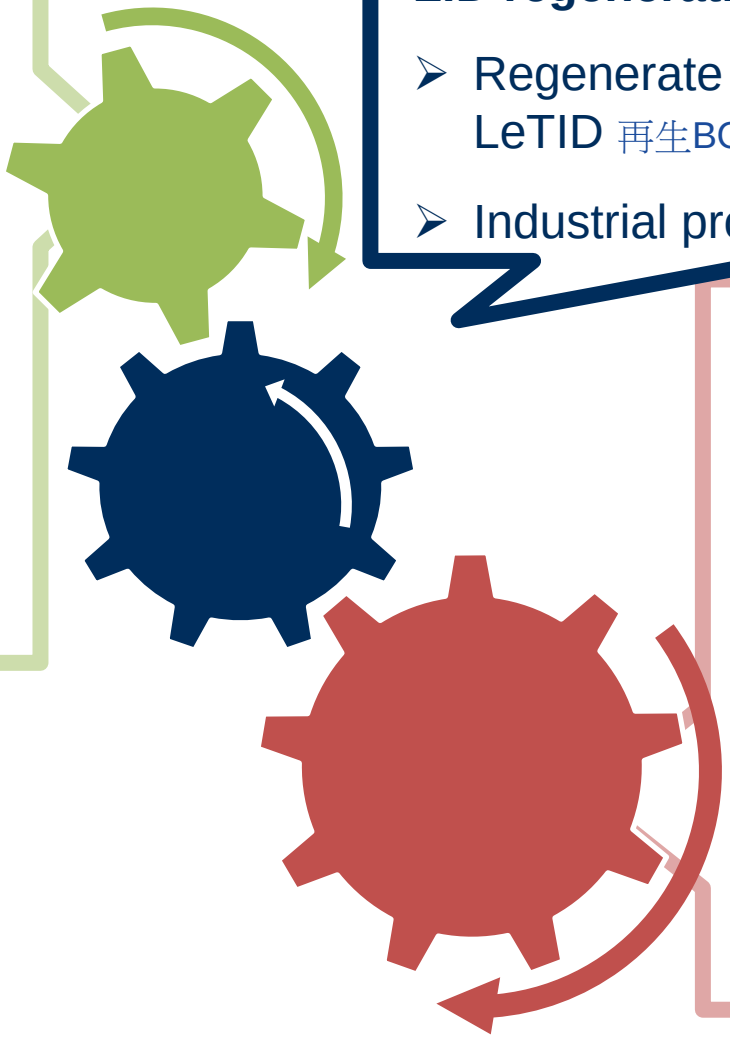
LeTID (light and elevated temperature induced degradation) （光和高溫導致的衰減）

- up to $\Delta\eta$ = -12%$_{rel}$
  高達$\Delta\eta$ = -12%rel
- within 100 to 1000 hours
  在100~1000小時之內
- depends on preceding processes
  取決於之前的流程
- Hydrogen suspected as cause
  懷疑是氫引起

LID Regeneration Tool – Challenges挑戰

BO related LID

- up to $\Delta\eta = -5\%_{rel}$
- within the first 24 hours
- depends on Boron and Oxygen concentration in Si
- Hydrogen need for regeneration



LID regeneration tool – challenges 挑戰

- Regenerate BO defects **AND** reduce LeTID 再生BO缺陷和減少LeTID
- Industrial process times 工業流程時間

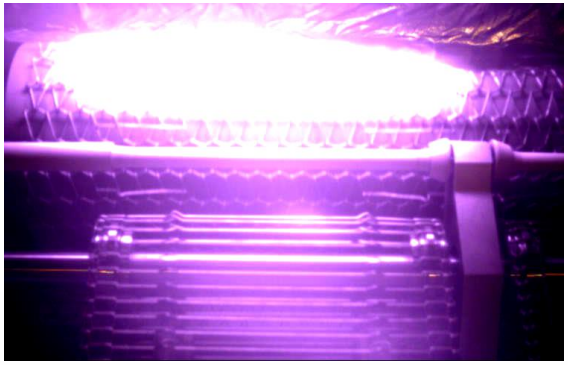
LeTID (light and elevated temperature induced degradation)

- up to $\Delta\eta = -12\%_{rel}$
- within 100 to 1000 hours
- depends on preceding processes
- Hydrogen suspected as cause

LID Regeneration Tool – Solution解決方案

Important Parameters for Regeneration 再生的重要參數

- Illumination intensity 光照強度
- Temperature 溫度



Laser illumination 激光照射

- High illumination intensity 高光照強度
- Flexible illumination profiles 靈活的光照曲線
- Ultra-fast regeneration in seconds 短時間超快再生

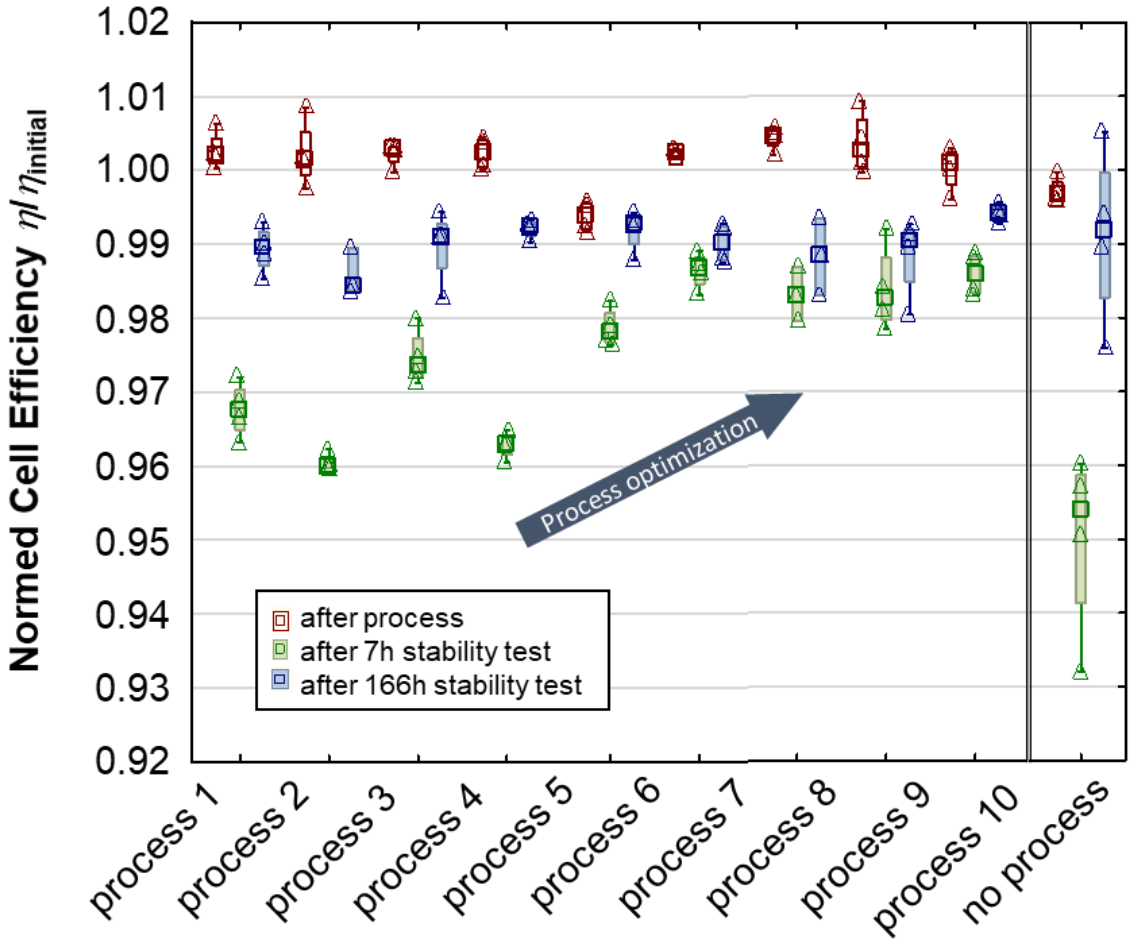
REHM‘s regeneration tool Rehm的再生工具

- Premium performance 優質的性能
- High process flexibility 高靈活性製程
- Laser safety class 1 激光安全等級1
- High throughput 高產出
- Low footprint & low maintenance 低佔地和低維護

LID Regeneration Tool – Solution解決方案

Sampling for Industrial Cell Manufacturer工業電池製造商抽樣

- Cells show slightly increased efficiency after process
  電池片在加工後的效率略有提高
- Applied stability test at elevated temperatures consideres
  在較高溫度下應用穩定性試驗
  - BO related LID
  - LeTID
- Overall efficiency degradation reduced to less than 2 $\%_{rel}$
  整體效率降低小於2 $\%_{rel}$

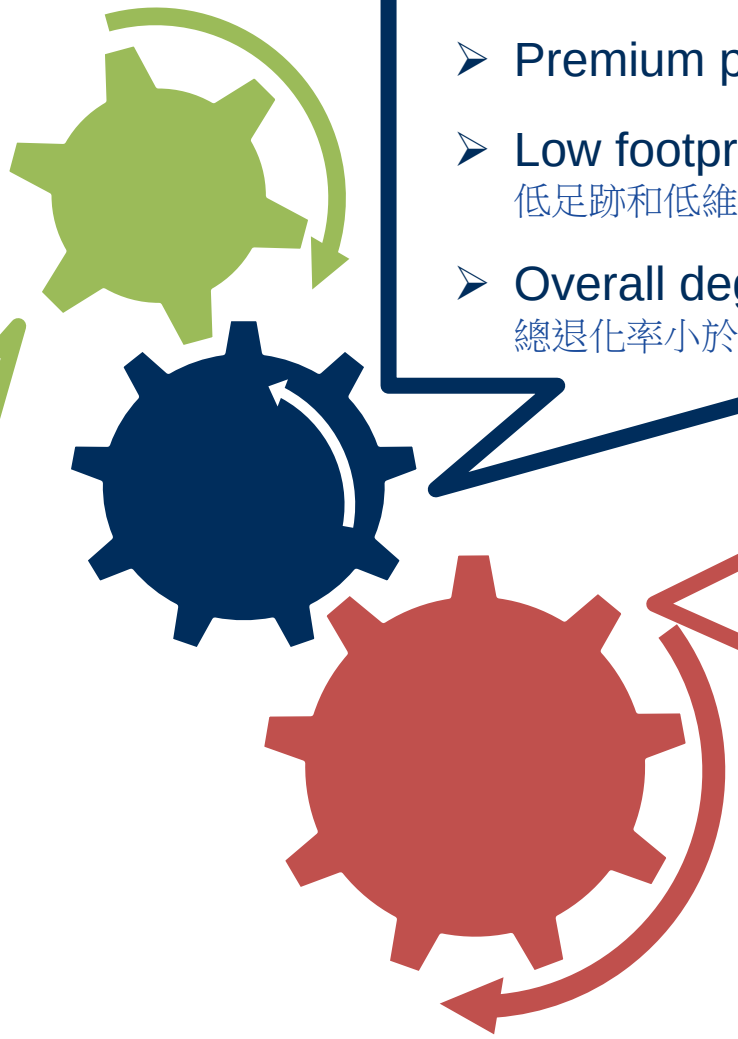


Conclusion总结

THERMAL SYSTEMS

Anti LID treatment – REHM‘s solution:

- Premium performance優質的性能
- Low footprint and low maintenance
  低足跡和低維護
- Overall degradation of less than $2\%_{rel}$
  總退化率小於$2\%_{rel}$



BO related LID

- up to 95 % of losses caused by BO defects can be prevented
  由於BO缺陷造成的損失高達95%是可以避免的

LeTID (light and elevated temperature induced degradation) LeTID（光和高溫導致的衰減）

- reduced to a loss less than $\Delta\eta = 1\%_{rel}$
  減少到損失小於$\Delta\eta = 1\%_{rel}$

Thank you for your attention!感謝你們的關注

We kindly invite you to our poster presentation 2DV.3.63
at EU-PVSEC in Brussels September 24th to 28th 2018
我們誠懇的邀請你參與我們展示2 DV.3.63
2018年9月24日至28日在布魯塞爾EU-PVSEC

For more information please contact us:
如欲了解更多信息，請與我們聯繫：

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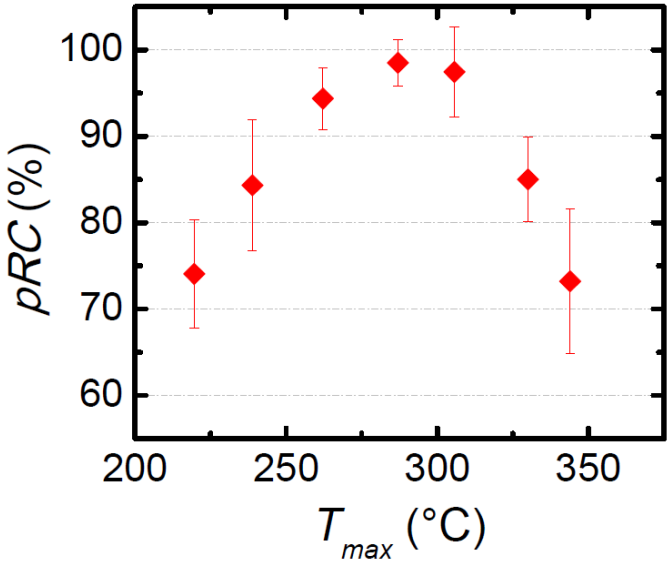
LID Regeneration Tool – Solution解決方案

THERMAL SYSTEMS

Fraunhofer ISE

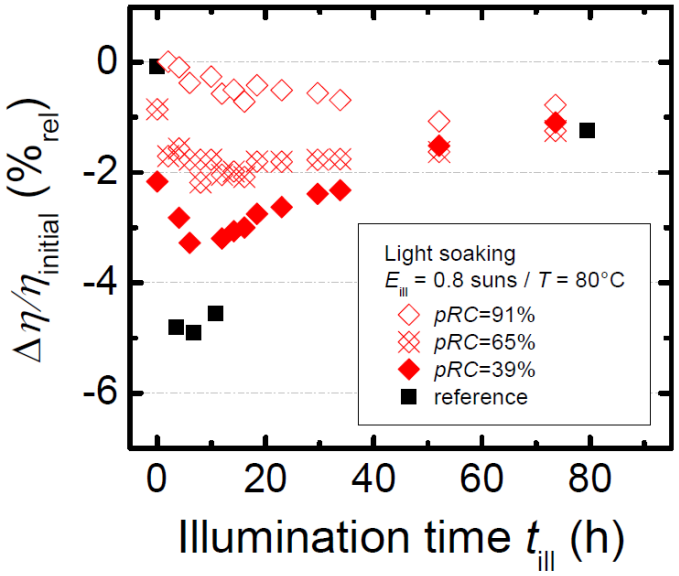
Research results in cooperation with Fraunhofer ISE與弗勞恩霍夫合作研究結果

BO defect regeneration
生BO缺陷再生



→ At optimum process temperatures more than 95 % of BO-related LID loss is prevented 在最佳工藝溫度下，超過95%的與BO相關的LID損失是可以避免的

LeTID prevention
LeTID預防



→ Cells with high BO regeneration completeness (*pRC*) show lowest extent of LeTID losses < $1\%_{rel}$
具有高BO再生完整性的電池（pRC）顯示的LeTID損失的最低程度小於1%rel