BRIGHTER FUTURE LOWER TEMPERATURE

BLUGLASS 2014 AGM PRESENTATION

24 November 2014

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THE YEAR IN REVIEW

George Venardos,
Non-Executive Chairman

A year of strong technical progress and our first revenue from the newly established custom epitaxy business – our Silverwater facility has been upgraded significantly, increasing our productivity

FACILITIES UPGRADE WORK

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FACILITY UPGRADE COMPLETE

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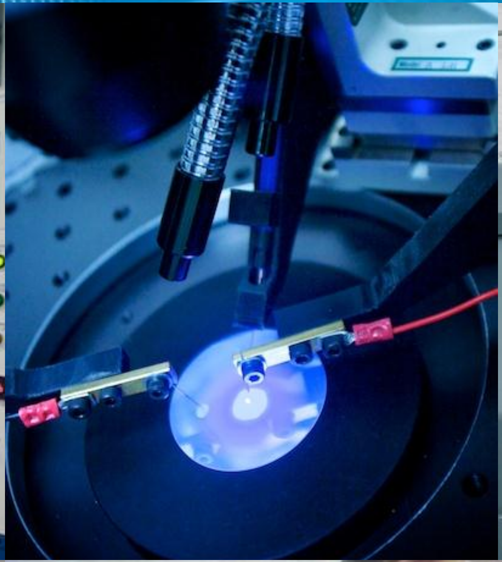


SIGNIFICANT PROGRESS DURING 2014

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December 2013	First customer revenues received for MOCVD custom epitaxy orders
During the Year	14 additional patents granted in strategic semiconductor markets
During the Year	Added three new key staff, including GaN and semiconductor hardware design experts
July 2014	Reported a large improvement (over previous results) in light output of RPCVD p-GaN grown on MOCVD partial LED structures
August 2014	Scaled-up RPCVD system (BLG-300) comes online after completion of facilities upgrade
October 2014	BluGlass ranked as Global Top 30 semi-finalist for Global Cleantech Cluster Association Later Stage Awards
November 2014	Received first early trial RPCVD custom epitaxy order Appointed US based expert custom epitaxy agent for MOCVD BLG-300 results now on par with BLG-180

2014 FINANCIAL RESULTS

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CURRENT CASH POSITION (as at 30 Sep 2014)	$3.6M

AS AT JUNE 30	FY12	FY13	FY14
Revenue and Other Income $'000	2,478	4,726	4,112
Net loss $'000	(6,231)	(1,676)	(2,898.4)
NET CASH	**3,549**	**5,590**	**2,445**

KEY CASH EVENTS:

- July 2013 - **$3M Cleantech Innovation Grant** (paid quarterly to end of CY 2015)
- September 2014 - **$2.14m R&D tax credit** (paid yearly in arrears)
- Total customer epitaxy revenue received to date **$413,000**
- **~$150,000** received in **custom epitaxy revenue** since July 2014
- Current Revenue / month rate is **$30K / month**
- Current capacity and staffing allows a Revenue / month rate of **$80K / month** (**$1M / year**) with no additional capital expenditure

THE YEAR AHEAD

Giles Bourne,
Managing Director

We expect the coming year to be one in which we gain customer acceptance for our technology

PERFORMANCE CARD

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WHAT WE SET OUT TO DO	WHAT WE ACHIEVED
TECHNOLOGY ▪ Meet milestones, especially p-GaN performance ▪ Accelerate R&D in other areas (GaN on silicon) ▪ Increase activity on PV technology and milestones	▪ Increased RPCVD light output and continued progress towards Brighter LED milestone ▪ Work commenced on GaN / silicon programme ▪ Upgraded facilities and commissioned a MOCVD & the BLG-300 RPCVD systems
MARKETS ▪ Continue to focus on LED, PV ▪ Evaluate other applications, e.g. power electronics	▪ LED market continues to drive our research efforts ▪ New LED and power electronics customers for BluGlass' custom epitaxy business ▪ There is increasing interest & opportunity for RPCVD in the power electronics and AlN markets
COMMERCIALISATION ▪ Continue dialogue with market leaders in the LED value chain ▪ Enter into commercialisation through a number of options including; licensing, strategic partnerships and providing foundry service	▪ Connected with tier 1 & 2 players in Asia and North America following mid-year technology results ▪ Launched custom epitaxy business and attracted new customers ▪ RPCVD customer trial has commenced

IP PORTFOLIO MANAGEMENT

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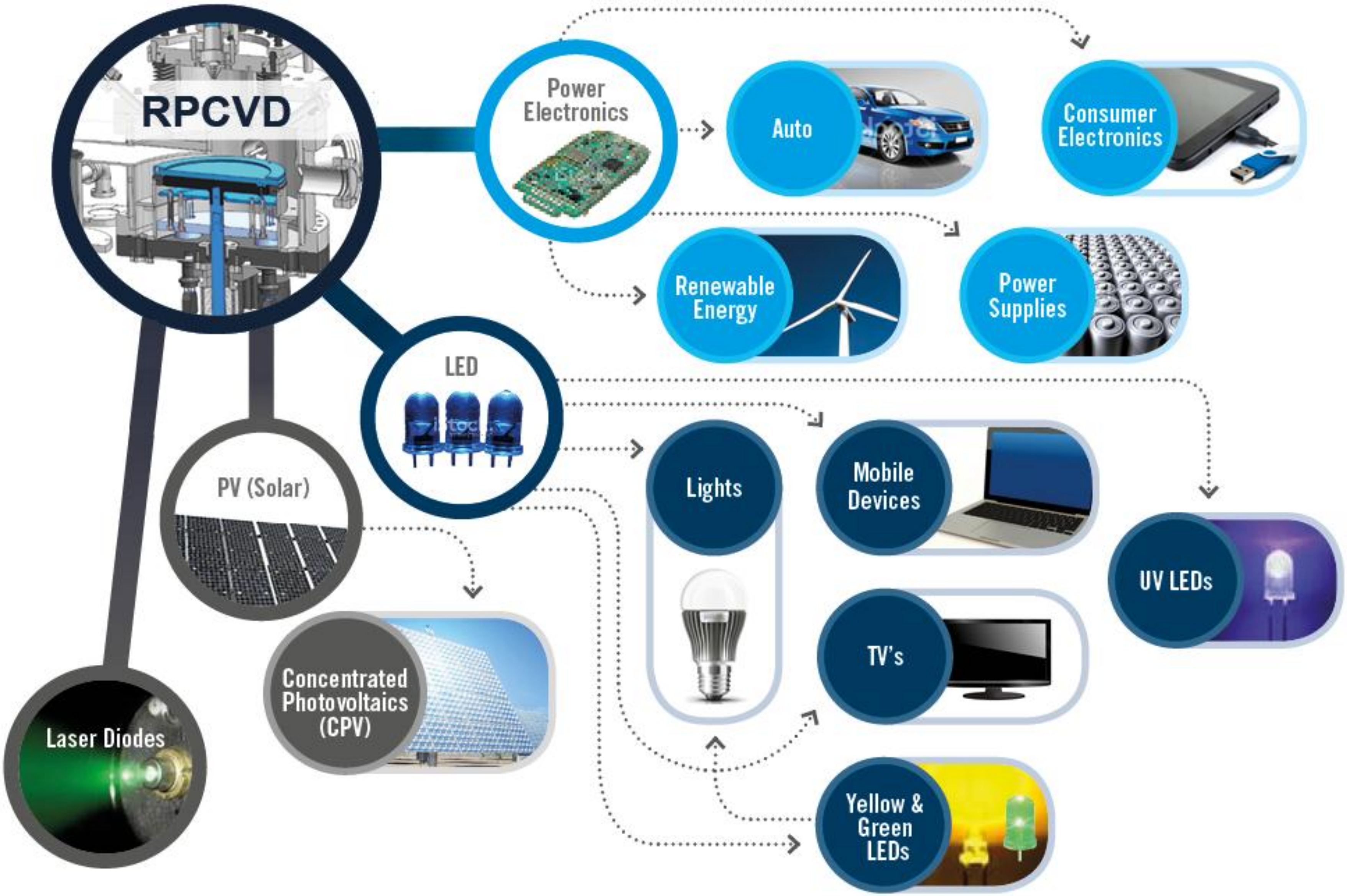
IP STRATEGY

We are building a defendable portfolio of patents whilst constantly monitoring the competitive landscape

2013		November 2014	
17	▪ **Pending patent applications**	15	▪ **Provisional and pending patent applications**
17	▪ **International granted patents in six patent families**	31	▪ **International granted patents in six patent families** ▪ Granted in key semiconductor markets including Europe, China, Japan and the US

RPCVD APPLICATIONS OVERVIEW



RPCVD COMMERCIALISATION OPTIONS

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	Vendor	Path to Market
Strategic Partner	e.g. LED Manufacturer	JV or licence
	e.g Nitride Foundry	JV or licence
	e.g. MOCVD / Semiconductor Equipment Manufacturer	JV or licence
	BluGlass	
Direct to Market	BluGlass Foundry	Custom epi service Phase I – III followed by expanded foundry i.e. build new facility
	BluGlass Equipment	Retrofit Business

Commercial discussions commenced - actively evaluating both the direct path to market or via a strategic partner

Note: A similar commercialisation approach applies to most of the RPCVD applications

HB LED PATH TO MARKET

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HB LED MARKET OPPORTUNITY

VALUE PROPOSITION	Low temperature p-GaN to enable increased LED efficiency by reducing the degradation of MQW during growth
STATUS	▪ p-GaN roadmap is progressing ▪ MQW and GaN / Si work has commenced ▪ Initial commercial discussions with LED device manufacturers and equipment manufacturers

POSSIBLE STRATEGIC PARTNER

Brighter LEDs Milestone Demonstration

(p-GaN or p-GaN + MQW) demonstrate that RPCVD offers higher performing devices

Industry Acceptance

Industry evaluation of RPCVD performance (customer, strategic partner etc)

Commercialisation

Commercialise the technology for LEDs via strategic partnership (device or equipment), or licensing

HB LED MARKET OPPORTUNTITY

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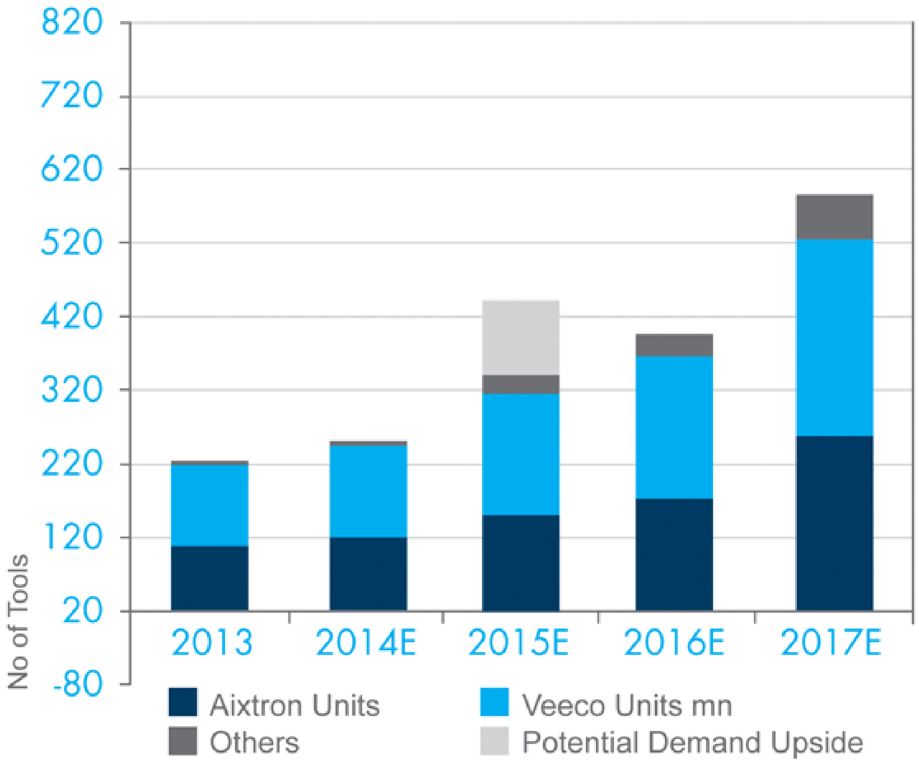
HB LED MARKET OPPORTUNITY

- LED lighting market will reach $25.6B of the $82B overall lighting market
- US $990M[1] Aixtron & Veeco MOCVD revenue in 2013
- CAGR of 14.13% (2013-2018)[1]
- 186-228 MOCVD shipped in 2014[2]
- Expected to reach 500[1] MOCVD systems shipped in 2017

MOCVD UNIT SALES 2013-2017E, (Gartner Research and Berenburg Estimate)



1. Berenburg Research, 18 July 2014
2. *DIGITIMES Research, 30 May 2014*

UV LEDs POTENTIAL RPCVD MARKET

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UV LEDs MARKET OPPORTUNITY	
VALUE PROPOSITION	RPCVD can potentially enable high quality aluminium (Al) rich AlGaN to achieve increased UV LED efficiency. There is a sizable market potential in water treatment and medical applications for UV LEDs. Currently using mercury tubes , however nitride based UV LEDs have many potential advantages such as size, performance, cost, higher efficiency & small form factor and less health risk in water purification and medical applications (no toxic mercury).
RPCVD ENABLERS	▪ Al rich p-AlGaN ▪ Al rich AlGaN MQW
PRODUCT / REVENUE OPPORTUNTITIES	▪ Foundry ▪ Retrofit Equipment
STATUS	▪ Not yet commenced

UV LEDs MARKET OPPORTUNITY

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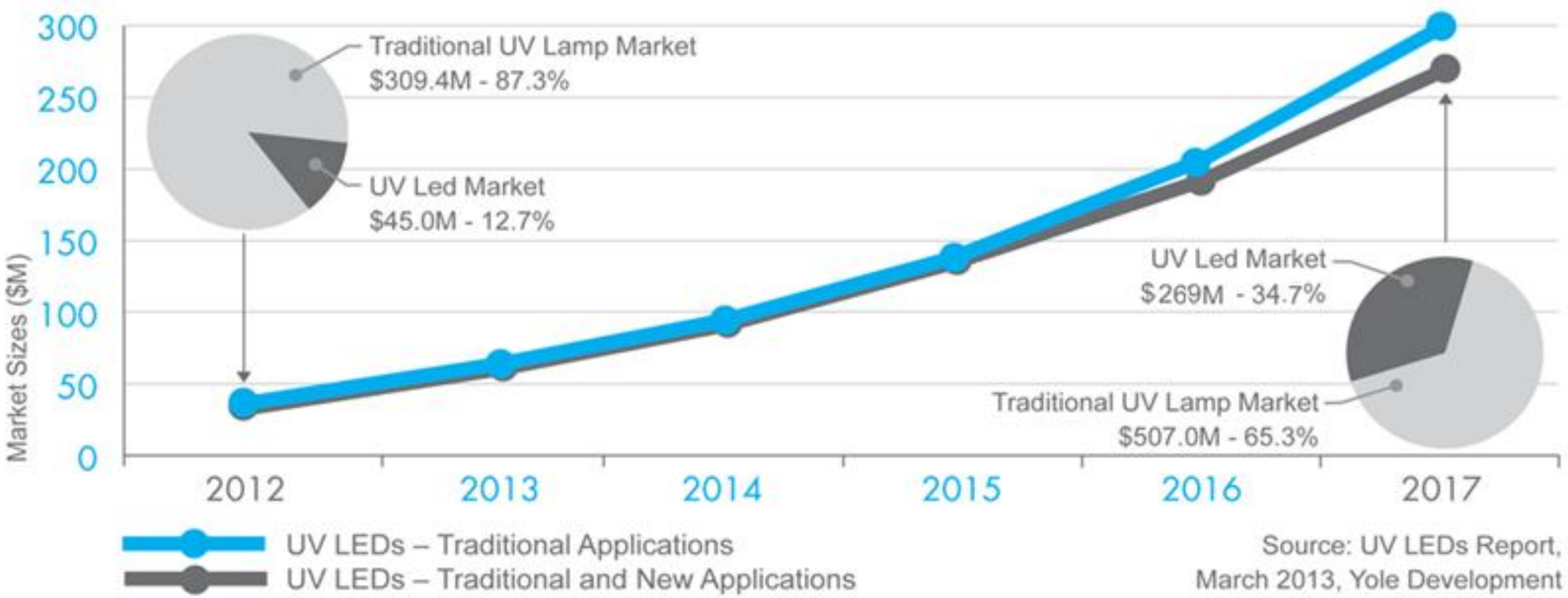
UV LED MARKET size 2012-2017
(UV LEDs Report, Yole Developement, March 2013)



UV LED MARKET OPPORTUNITY

- UV LED is expected to grow from $45M in 2012 to nearly $270M by 2017[3] with a CAGR of ~43%[3]

3. UV LEDs Report Yole Developement, March 2013

GREEN & YELLOW LEDs

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GREEN & YELLOW LEDs MARKET OPPORTUNITY	
VALUE PROPOSITION	Low temperature p-GaN to enable increased LED efficiency by reducing the degradation of the MQW during growth. Low temperature RPCVD can potentially enable high quality indium rich InGaN MQWs necessary for longer wavelength LEDs such as green and yellow.
MARKET OPPORTUNITY	▪ Yellow LEDs are a compelling technology alternative to the use of yellow phosphor coated blue LEDs for the general lighting market ▪ Green LEDs can be used in RGB lighting applications
RPCVD ENABLERS	▪ Low temperature p-GaN ▪ Indium rich InGaN MQW
PRODUCT / REVENUE OPPORTUNTITIES	▪ Custom epitaxy / foundry ▪ Equipment retrofit - p-GaN / MQW systems
STATUS	▪ Early trials commenced

InGaN CPV PATH TO MARKET

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InGaN CPV MARKET OPPORTUNITY	
VALUE PROPOSITION	InGaN has a direct band gap with wide tunability. This can potentially be exploited in a solar cell to allow more energy to be converted to power from the solar spectrum. RPCVD has the potential to grow indium (In) rich InGaN due to its low temperature process capability.
STATUS	▪ Climate Ready grant initiated R&D resulting in key patent filed ▪ Discussions underway with external granting authorities

POSSIBLE STRATEGIC PARTNER

InGaN Performance Demonstration

Show improved performance indium rich InGaN

Product Prototyping

Demonstrate InGaN solar cell prototypes: InGaN / silicon, tandem solar cells on silicon & multi junction cells

Commercialisation

Commercialise the technology for CPV via strategic partnership (device), licensing and / or foundry

InGaN CPV MARKET OPPORTUNTITY

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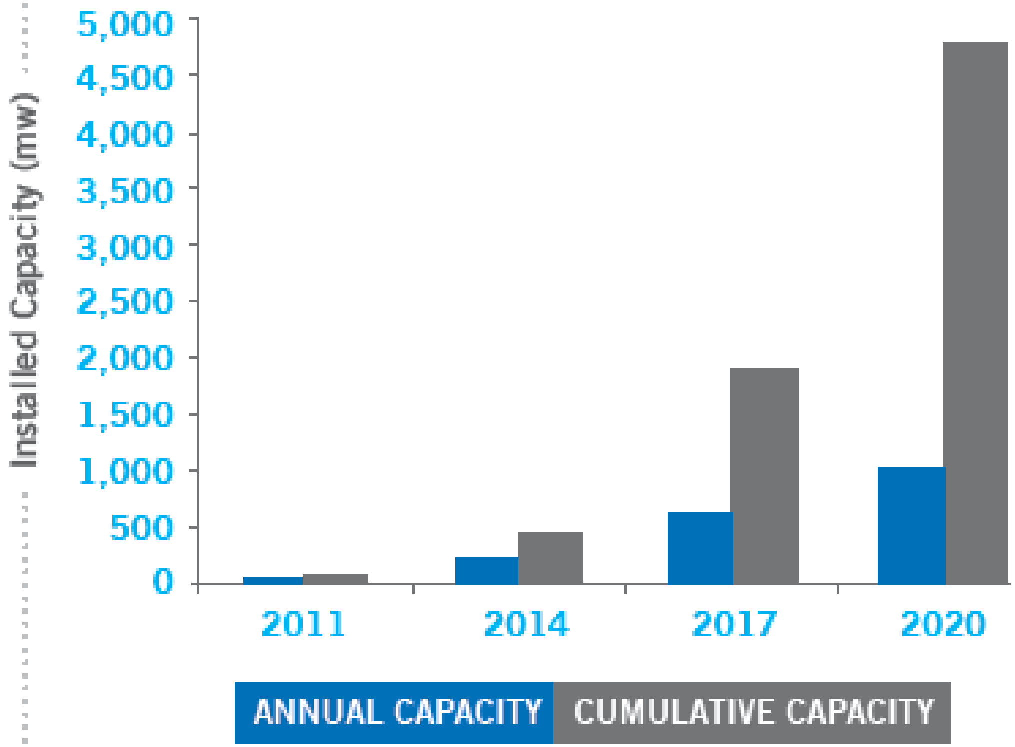
InGaN CPV MARKET OPPORTUNITY

- CPV market is expected to grow to 4.75GW by 2020[4]
- CPV continues to emerge as the most effective method to deliver large scale, cost effective renewable energy from the sun

CPV MARKET, GLOBAL INSTALLED CAPACITY, MW 2011-2022



SOURCE: GlobalData; Primary research with C (Chief) - level marketing and technical experts in Italy, the UK, Spain, China and the US

4. GlobalData, Primary Research

POWER ELECTRONICS PATH TO MARKET

POWER ELECTRONICS MARKET OPPORTUNITY	
VALUE PROPOSITION	GaN / Si is prone to cracking and bowing during high temperature manufacture due to large lattice & thermal mismatch Low temperature RPCVD has the potential to reduce bowing, cracking and to simplify the process
STATUS	▪ Commenced initial work on BLG-180 and BLG-300. The BLG-300 enables BluGlass to commence work on larger size wafers (up to 1 x 8 inch)

POSSIBLE STRATEGIC PARTNER

GaN HEMT on Silicon Performance Demonstration

Show improved (over MOCVD) GaN process on silicon wafers

Industry Acceptance

Industry evaluation of RPCVD GaN HEMT / Si performance (customer, strategic partner etc)

Commercialisation

Commercialise the technology for power electronics via strategic partnership (device or equipment), licensing and /or foundry and equipment retrofit

POWER ELECTRONICS MARKET OPPORTUNTITY

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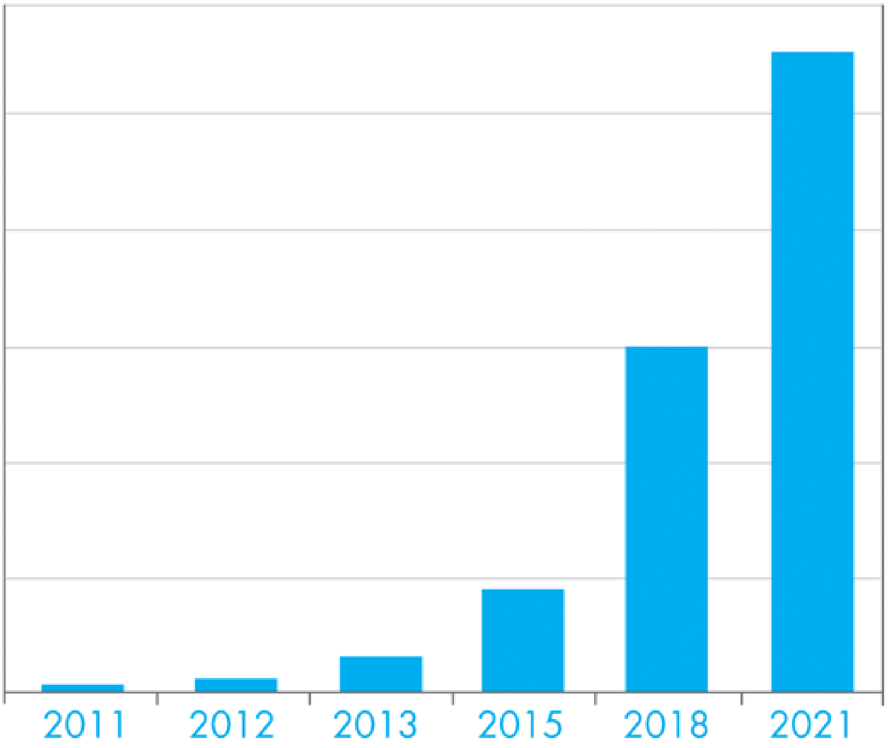
POWER ELECTRONICS MARKET OPPORTUNITY

- GaN power electronics is an emerging market, worth $12.6M in 2012[5]
- Forecast CAGR of 63.7% to 2022 to reach $1.75B[5]

GaN POWER DEVICE MARKET

IMS Research Feb 2012



5. IMS Research, Feb 2012

LASER DIODES POTENTIAL RPCVD MARKET

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LASER DIODES MARKET OPPORTUNITY	
VALUE PROPOSITION	The same value proposition that exists for HB LEDs through low temperature p-GaN is applicable for the Laser Diode market offering improved device efficiency through reduced degradation of the MQW
MARKET OPPORTUNITY	▪ The global laser diode market was valued at US $4.6B in 2013[6] ▪ With an expected CAGR of 12.6% from 2014-2020[6] ▪ Estimated to reach US $10.26B in 2020[6]
RPCVD ENABLERS	▪ Low temperature p-GaN
PRODUCT / REVENUE OPPORTUNTITIES	▪ Custom epitaxy / foundry ▪ Equipment retrofit
STATUS	▪ Not yet commenced

6. Transparency Market Research "Laser Diode Market - Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2014 - 2020,

ALUMINIUM NITRIDE TEMPLATES

ALUMINIUM NITRIDE TEMPLATES MARKET OPPORTUNITY	
VALUE PROPOSITION	Potential for lower defect density which can lead to significantly improved device efficiency and performance output in power electronic and LED applications
MARKET OPPORTUNITY	Power electronics and LEDs (including UV LEDs) - see market data for Power electronics and LEDs
RPCVD ENABLERS	▪ Low temp AlN on sapphire or silicon
PRODUCT / REVENUE OPPORTUNTITIES	▪ Custom epitaxy / foundry ▪ Equipment Retrofit
STATUS	▪ Initial R&D work commenced

CUSTOM EPI/ FOUNDRY PATH TO MARKET

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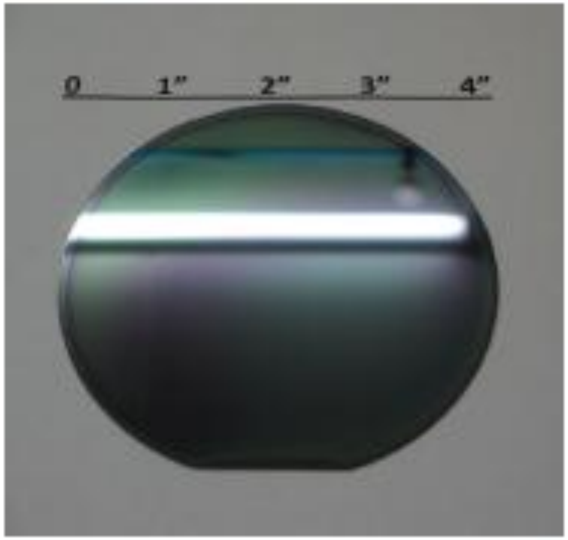
CUSTOM EPITAXY / FOUNDRY MARKET OPPORTUNITY	
VALUE PROPOSITION	MOCVD capability with leading edge staff Fast prototyping
PRODUCT / REVENUE OPPORTUNTITIES	▪ LED wafers ▪ Power electronics wafers ▪ Other applications
STATUS	▪ BluGlass now has multiple customers and growing revenue generation ▪ Engaged xVI (USA) as a distribution partner for MOCVD custom epitaxy ▪ Current revenue ~$30K/month with the potential to reach $80k / month or $1M p.a

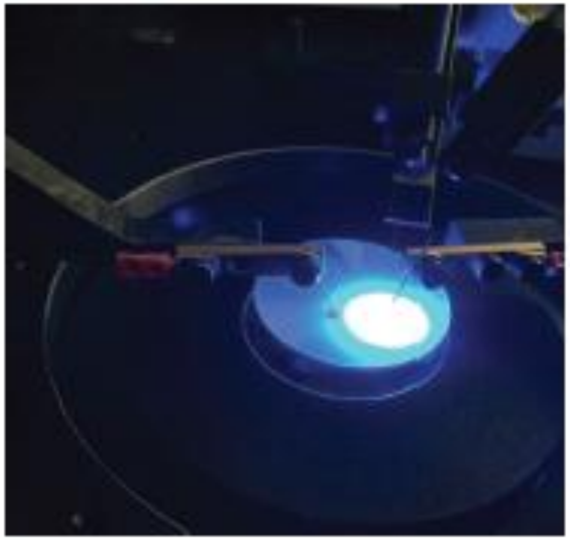
PHASE 1	PHASE 2	PHASE 3
Additional revenue for BLG by utilising existing MOCVD system spare capacity. **Potential for approximately $1M in revenue p.a.**	Increase capacity (extra staffing and shifts, no additional CAPEX). Potential to expand to **$2.4M** in revenue p.a	MOCVD expansion and increase emphasis on RPCVD services. Increase system capacity (CAPEX ~$1.8M) with a maximum revenue potential of **$12M**

THE CUSTOM EPITAXY BUSINESS

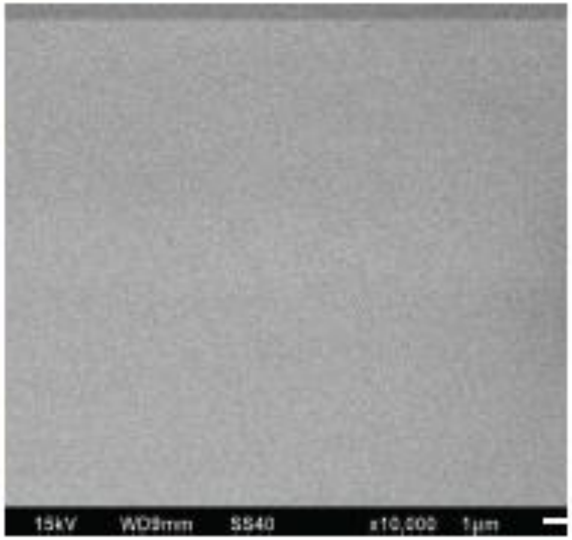
GALLIUM NITRIDE (GaN) EPITAXIAL WAFERS



GaN-ON- SILICON



GaN-ON-SAPPHIRE



GaN-ON-GaN

BluGlass offers Gallium Nitride based Research & Development services for the manufacture of custom nitride templates and device wafers through an agreement with xVI Technologies.

MOCVD & RPCVD CUSTOM EPI CAPABILITY

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THE TECHNOLOGY UPDATE

Dr. Ian Mann,
Chief Operations and Technology Officer

Significant improvement in our low temperature p-GaN LED performance has led to several key industry inquiries and has attracted interest in RPCVD for other applications

BENEFITS OF RPCVD FOR LEDs

A low temperature growth system such as RPCVD may offer LED manufacturers compelling performance advantages at several stages of device growth. Low temperature p-GaN is one area that BluGlass is presently focusing on.

LED STRUCTURE GROWN USING MOCVD

- **p-GaN grown at intermediate to high temperature**
- Multi-Quantum-Well (MQW) InGaN layer, the ***ACTIVE REGION*** of an LED - grown at low temperature
- **n-GaN grown at high temperature**
- **GaN grown at high temperature**
- **Substrate**

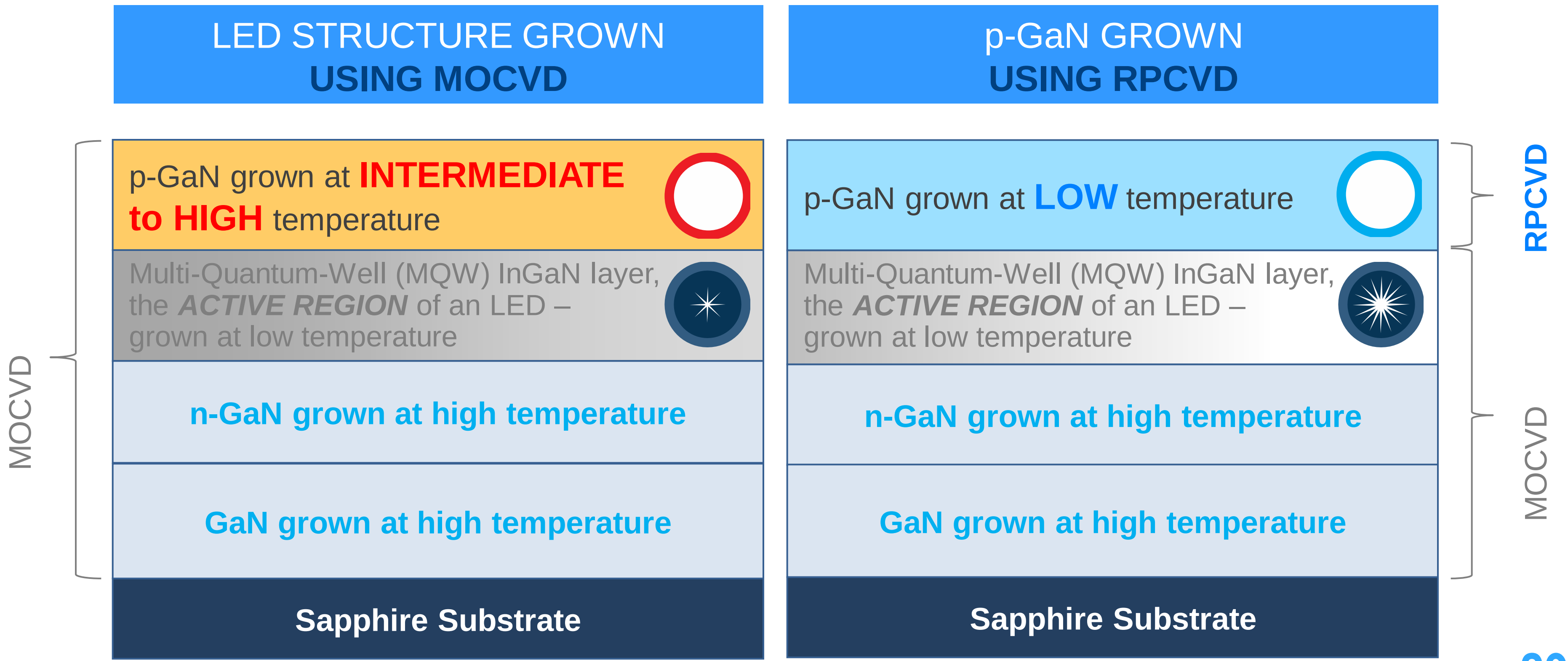
BENEFITS OF RPCVD GROWTH

The higher temperature growth of the p-GaN top layers compared to the MQW layer can cause degradation to the active MQW layer and reduce the LEDs light output. MOCVD cannot effectively grow high performance p-GaN at lower temperatures.

RPCVD has great potential to improve device performance by growing a low temperature p-GaN layer which in turn improves the stability of the InGaN layer during growth.

HB LED: LOW TEMPERATURE p-GaN

Using BluGlass's MOCVD to grow partial LEDs and then overgrow with RPCVD p-GaN has shown steady improvements in the device light output and efficiency over the year. While not at the MOCVD benchmark performance yet, progress has been significant enough to attract a number of key industry players inquiring into low temperature p-GaN and other aspects of the RPCVD process.



2013/14 Technical Progress (1)

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Implemented a critical hardware improvement – an enhanced plasma source capable of producing a high density of active nitrogen

- Rationale (a) – A high density of active nitrogen assists in improving film quality
- Rationale (b) – For scaling to larger volume chambers more active nitrogen is required

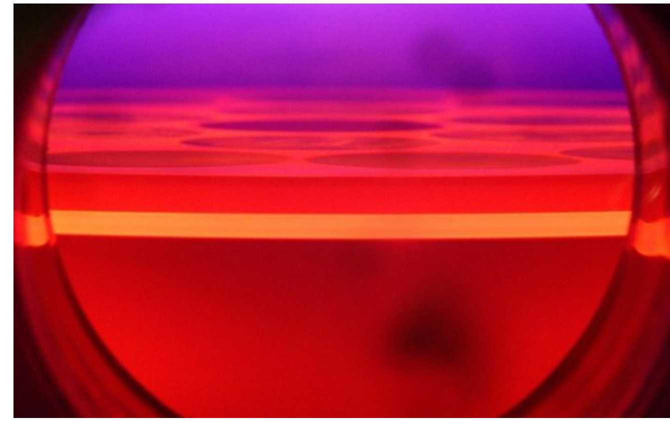
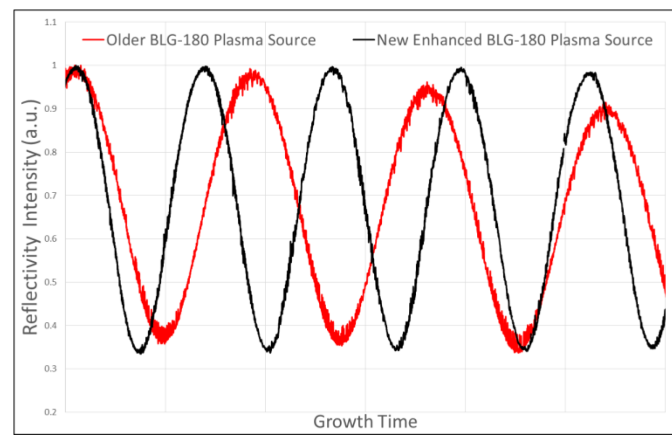


Image of historic BluGlass nitrogen plasma

Outcomes/Progress:

1. The enhanced plasma source produced a higher density of active nitrogen species than all previous designs, confirming the validity of the design
2. The bulk p-GaN growth rate was enhanced by approximately 50%
3. The p-GaN morphology was improved (smooth films were readily achieved)

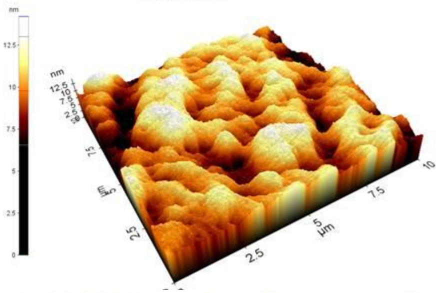


2014 TECHNICAL PROGRESS (2)

Integrated MOCVD and RPCVD growth

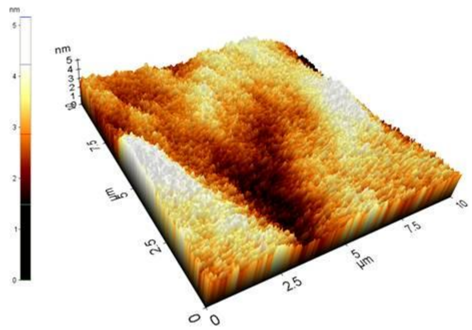
- Rationale (a)– The last layer grown in MOCVD becomes the starting growth surface for RPCVD - to date RPCVD has grown best on smooth surfaces
- Rationale (b)– The last layer(s) grown in MOCVD must protect the MQW from the subsequent cool down in MOCVD and the transfer to RPCVD

1TS 0376 200A uGaN cap MQW



Rough MOCVD MQW

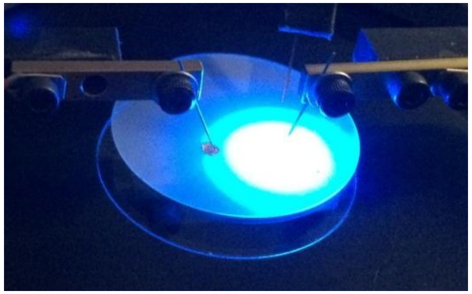
1TS 0374 uGaN template



Smooth MOCVD template

Outcomes/Progress:

1. Modest changes in MOCVD recipes have led to improved RPCVD p-GaN based LED performance
2. Oxygen impurities at the RPCVD p-GaN / MOCVD MQW interface have been addressed
3. Significant improvement of LED results were achieved through surface preparation approaches used in the RPCVD chamber but more work is needed to improve the starting conditions of RPCVD to achieve improved LED efficiency



2014 TECHNICAL PROGRESS (3)

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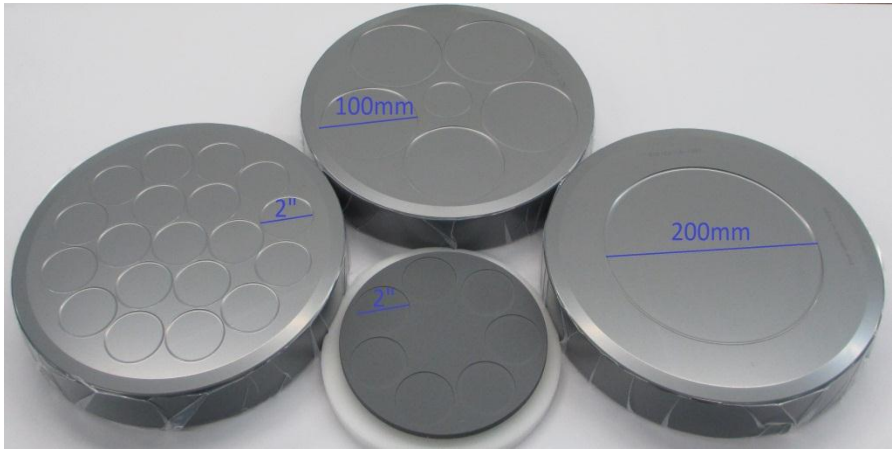
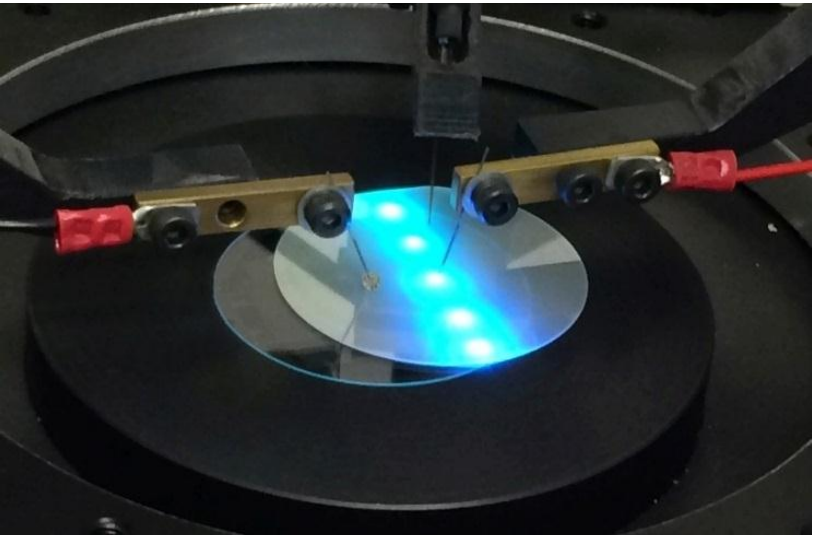
Scaled the plasma technology to a larger deposition area RPCVD system



- Rationale (a)— Need to convince potential customers that the RPCVD technology is readily transferable from the prototype system (BLG-180) to larger platforms (BLG-300)
- Rationale (b)— With two RPCVD systems we can address the key milestones more productively than with a single system



Outcomes/Progress:

1. Successfully transferred the RPCVD technology from the BLG-180 to the BLG-300
2. Initial BLG-300 p-GaN LED results show device performance approaching the BLG-180 best efforts
3. GaN on Si work has commenced

HB LED: p-GaN AND MQW GROWN USING RPCVD

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Several industry inquiries related to the ability to develop an RPCVD system capable of doing both the MQW and p-GaN to exploit the advantages of low temperature combined with the high growth rate capability of MOCVD for the thicker underlying n-GaN and GaN layers..

LED STRUCTURE GROWN **USING MOCVD**	p-GaN GROWN **USING RPCVD**
p-GaN grown at **INTERMEDIATE to HIGH** temperature	p-GaN grown at **LOW** temperature
Multi-Quantum-Well (MQW) InGaN layer, the ***ACTIVE REGION*** of an LED – grown at low temperature	Multi-Quantum-Well (MQW) InGaN layer, the ***ACTIVE REGION*** of an LED – grown at low temperature
n-GaN grown at high temperature	**n-GaN grown at high temperature**
GaN grown at high temperature	**GaN grown at high temperature**
Sapphire Substrate	**Sapphire Substrate**

Left structure (all layers above substrate): MOCVD

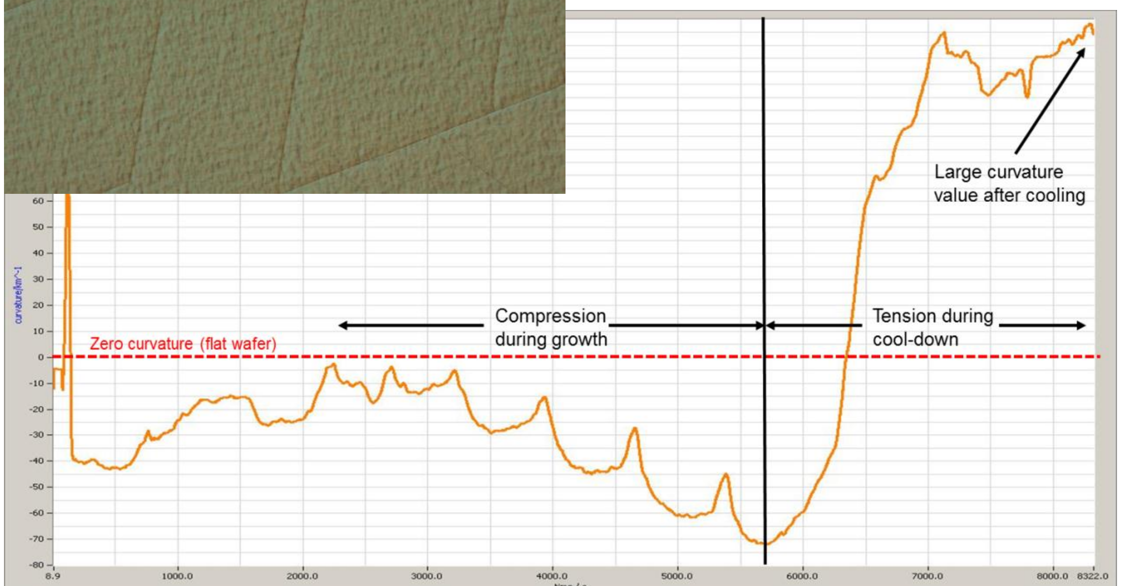
Right structure: top two layers RPCVD; n-GaN and GaN layers MOCVD

HB LED: LOW TEMPERATURE GaN ON SILICON

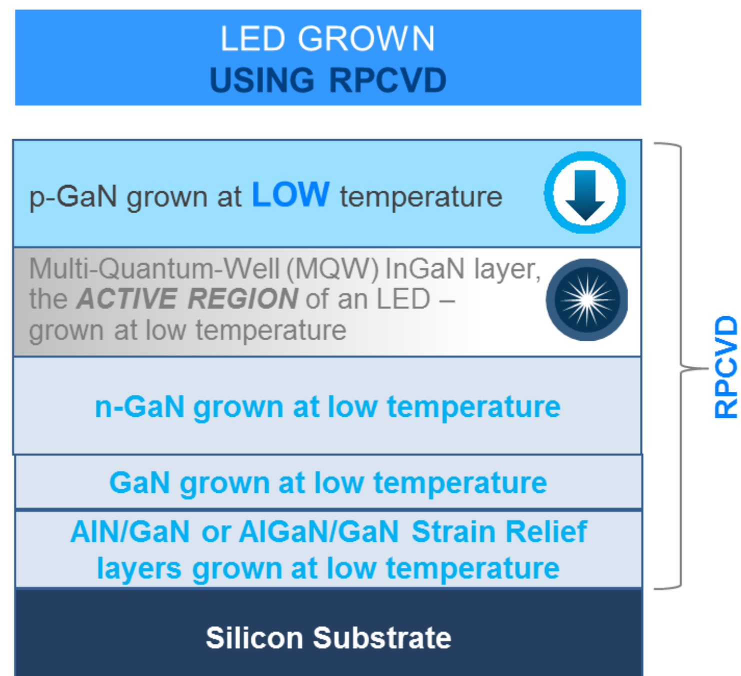
In 2013, BluGlass was awarded a $3M Grant from the Australian Government to advance the RPCVD technology for LEDs on Si – combining the potential low temperature advantages of p-GaN to improve the device efficiency whilst reducing the bowing when growing on larger silicon wafers. The new BLG-300 was designed for this type of demonstration.

Optical microscope image of cracked GaN (unoptimised MOCVD growth on Si)

In-situ measurement of bowing during unoptimised MOCVD growth of GaN on Si

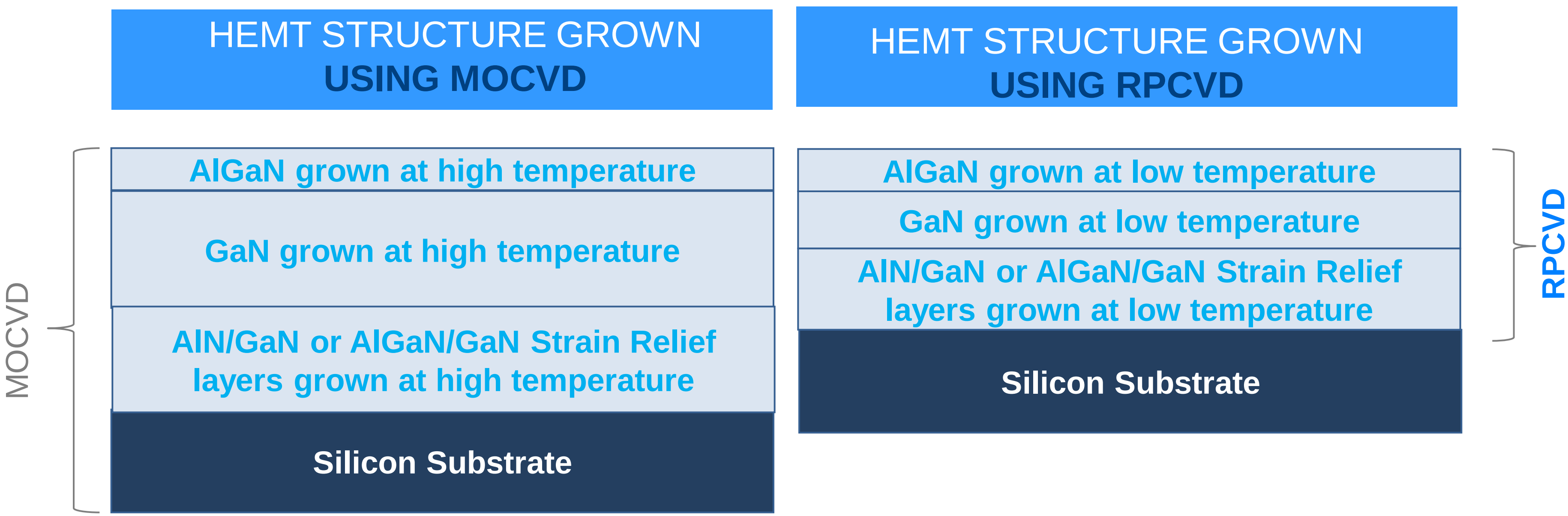


Proposed RPCVD Growth of Full LED on Si



POWER ELECTRONICS:
LOW TEMPERATURE GaN ON SILICON

GaN based power electronics applications use significantly different structures of nitrides compared to LEDs. These GaN applications typically require a high electron mobility transistor structure (HEMT) grown on Si, which have similar issues to GaN based LEDs grown on Si – challenges with wafer bowing and cracking when large substrates are used.



Bowing and cracking concerns due to large mismatch in thermal expansion between Si and GaN. Complex strain relief structures are required to try to manage bow and cracking.

Reduced bowing and cracking concerns due to lower temperature growth of RPCVD. Simpler strain relief structures can potentially be used.

NITRIDES FOR SPECIFIC APPLICATIONS:
Technical primer

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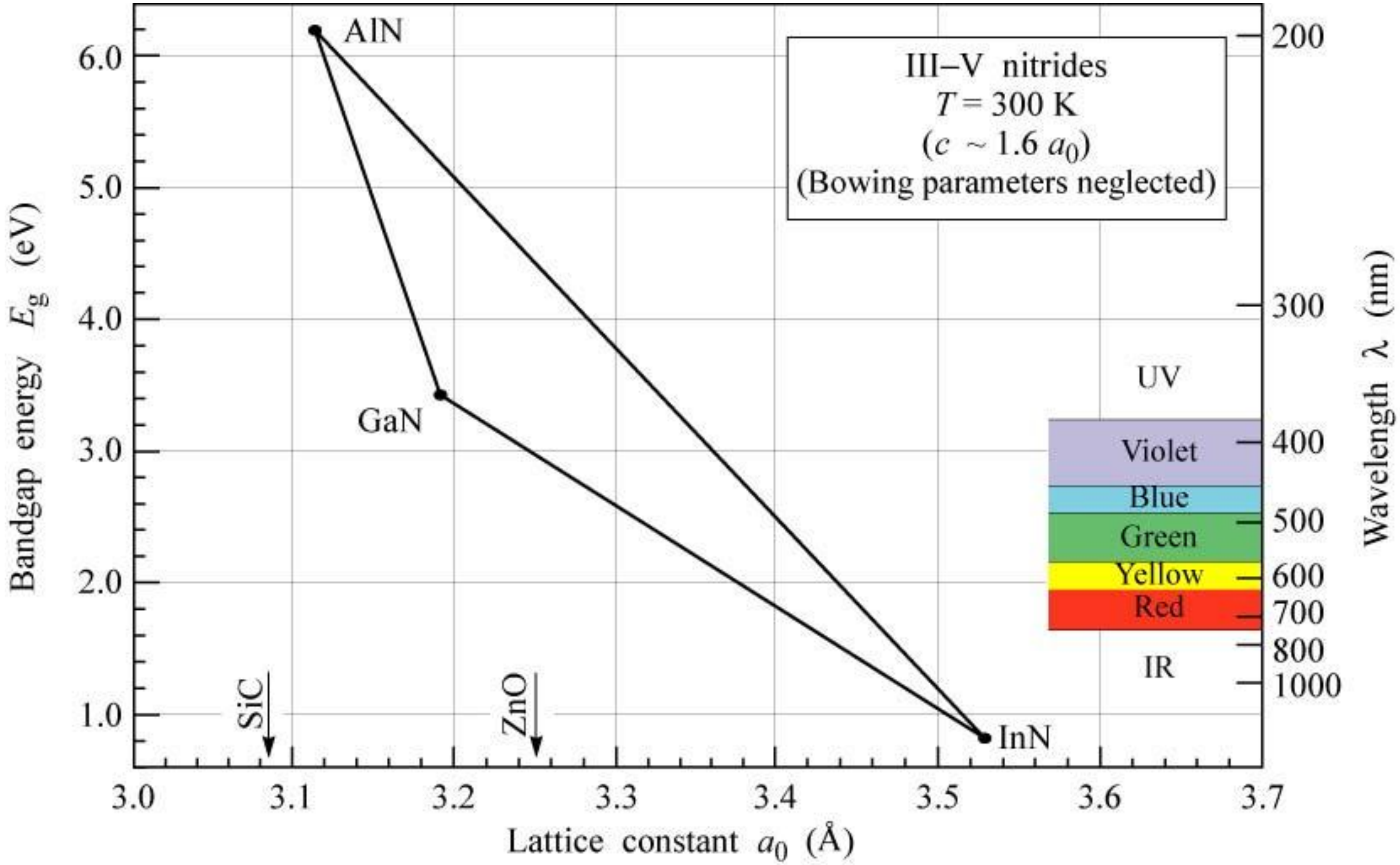

Fig. 12.12. Bandgap energy versus lattice constant of III–V nitride semiconductors at room temperature.

E. F. Schubert
Light-Emitting Diodes (Cambridge Univ. Press)
www.LightEmittingDiodes.org

CONCENTRATED PHOTOVOLTAICS (CPV):

INDIUM RICH InGaN

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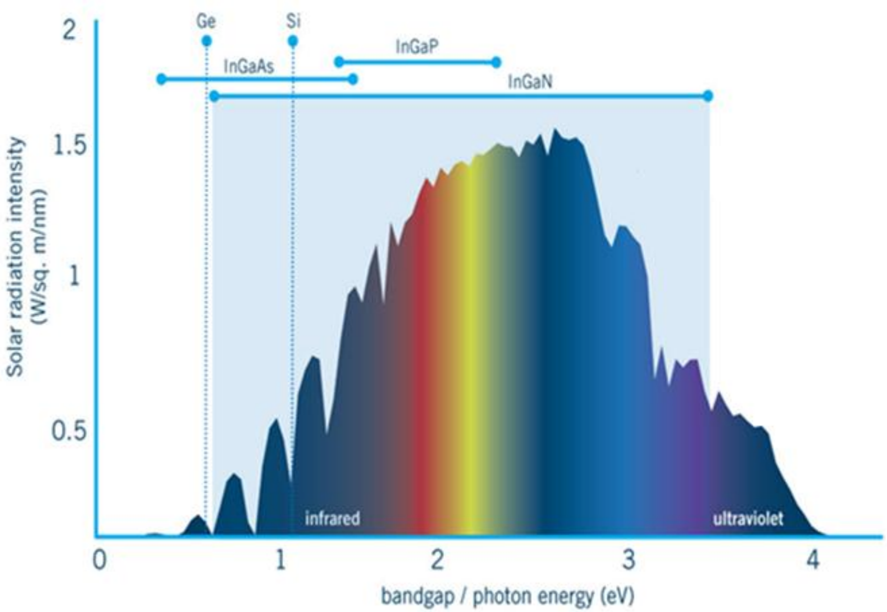
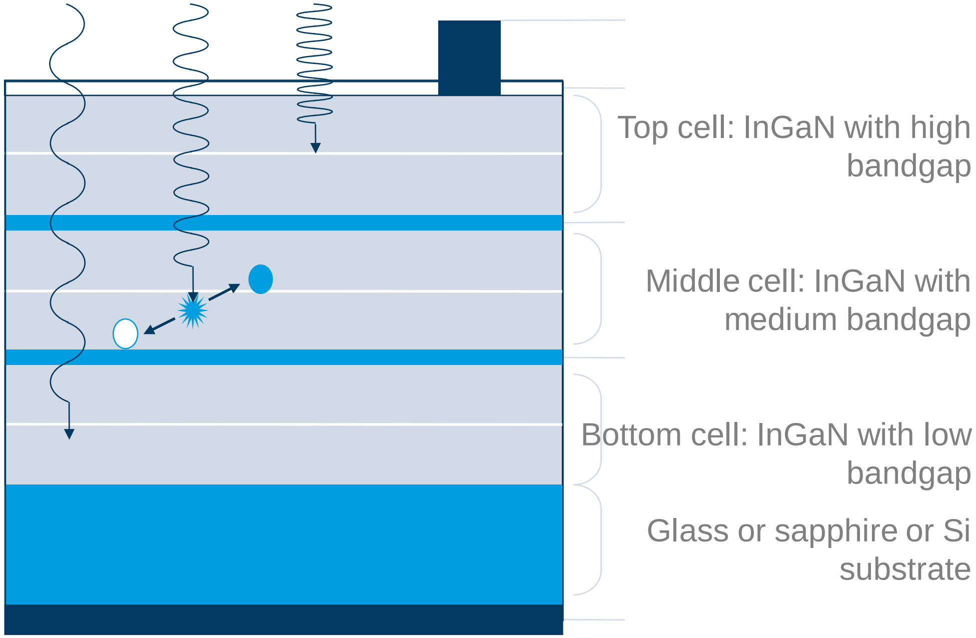
The potential advantage of RPCVD for CPV involves the tuning of InGaN composition with low temperature to enable indium rich InGaN compositions not readily accessible with MOCVD. A multi-junction InGaN solar cell has the potential for very high efficiency, in excess of the conventional CPV cells today that are based on Ge/InGAs/InGaP.

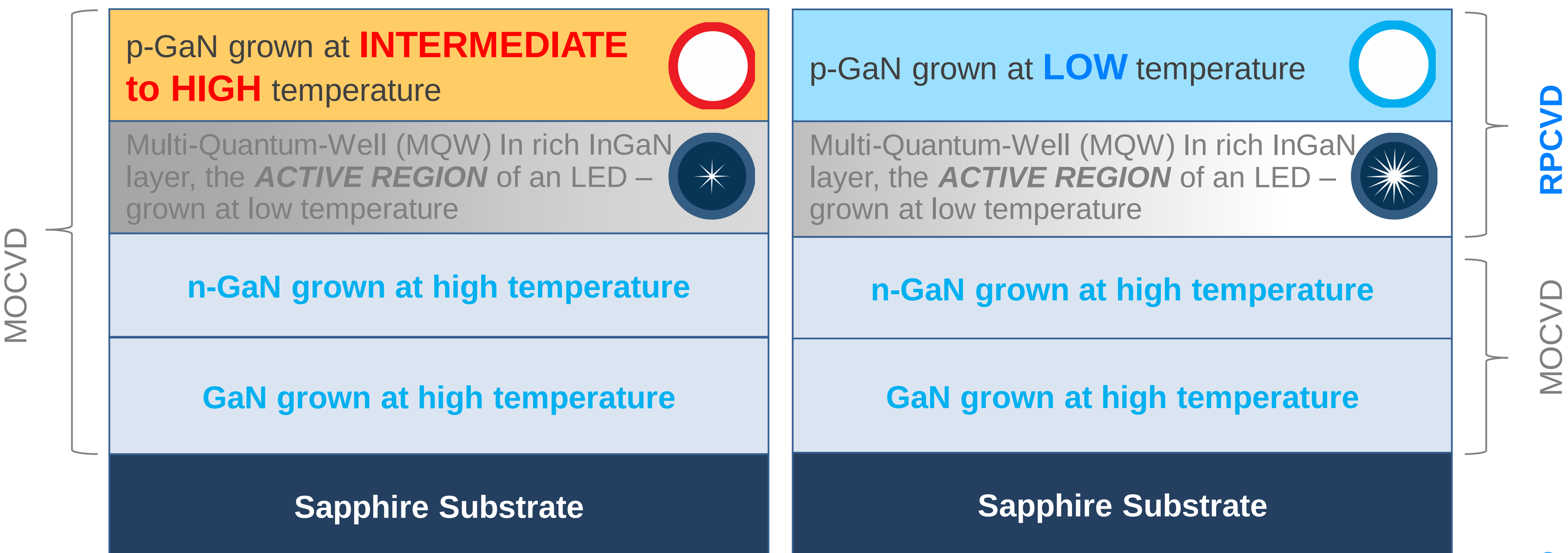




GREEN AND YELLOW LEDS (AND LASER DIODES): LOW TEMPERATURE p-GaN AND In RICH MQW

Longer wavelength nitride based LEDs or Laser Diodes (green, yellow or red) require indium rich MQWs. This requires growing the MQW at lower temperatures (even lower than for blue) which in turn amplifies the MQW degradation issue when growing higher temperature p-GaN on top. RPCVD can potentially combine the low temperature advantage to obtain indium rich MQWs and the low temperature p-GaN to achieve very high efficiency long wavelength devices.

LED STRUCTURE GROWN **USING MOCVD**	p-GaN GROWN **USING RPCVD**



UV LED: ALUMINUM RICH AlGaN

MOCVD grown UV LEDs currently exhibit low efficiencies - significant improvement is required to address this market. One issue with MOCVD is the requirement for high quality Al rich AlGaN structures that are very difficult to achieve in conventional MOCVD systems where the maximum operating temperature is limited to below what is required to produce high quality Al rich AlGaN.

UV LED GROWN
USING RPCVD

p-GaN/p-AlGaN

Multi-Quantum-Well of Al rich AlGaN layer
ACTIVE REGION of an UVLED

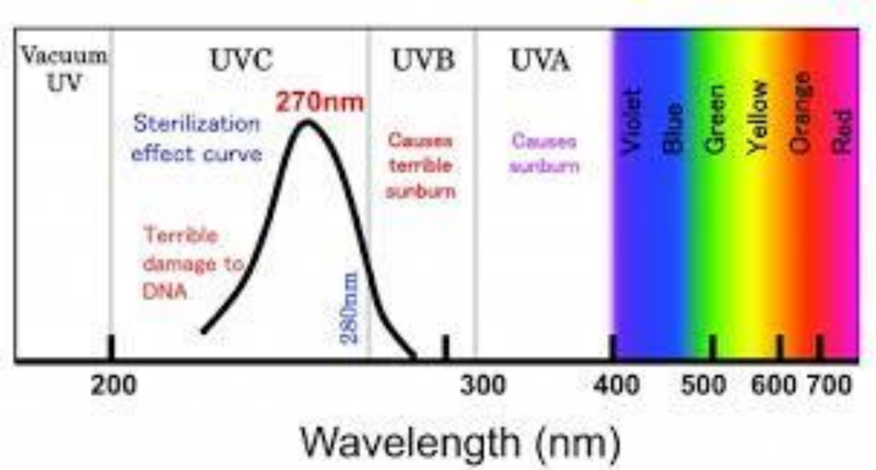
n-AlGaN grown at low temperature

AlN/AlGaN Strain Relief layers

AlN

Sapphire Substrate

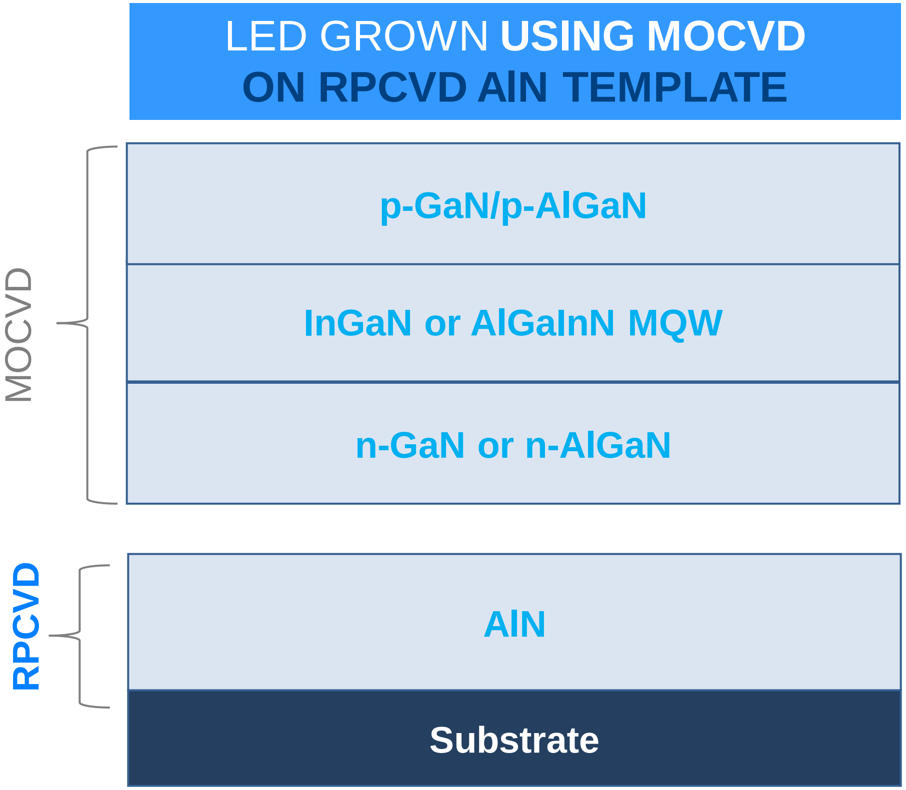
RPCVD

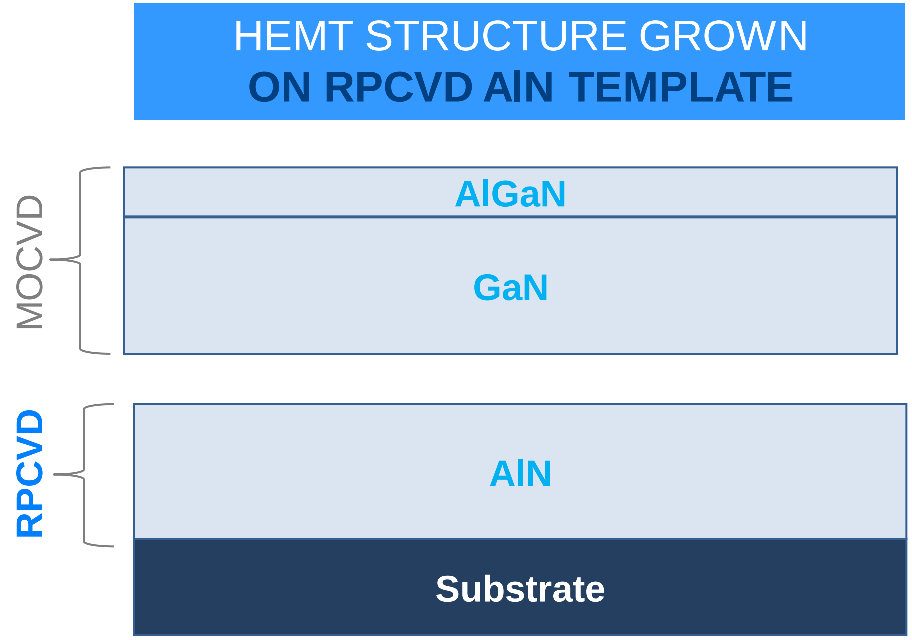


RPCVD AlN TEMPLATES

BRIGHTER FUTURE LOWER TEMPERATURE

Another potential use of RPCVD is for growing high quality AlN templates at lower temperatures possible than in MOCVD. These types of templates can be used in many of the typical GaN applications including LEDs (including UV LEDs) and power electronics. This could provide an opportunity to sell wafers to the industry to manufacture devices with improved performance.





THANK YOU

BRIGHTER
FUTURE LOWER
TEMPERATURE