23 November 2020

BluGlass 2020 AGM Chair, Managing Director and CTO Address

Australian semiconductor technology developer, **BluGlass Limited (ASX:BLG)** is pleased to present its 2020 Annual General Meeting.

Chair's Report

My name is James Walker, I am the Non-Executive Chairman of BluGlass Limited, and I am pleased to welcome you to the 2020 Annual General Meeting of the company.

The Company Secretary has advised me that the meeting is properly constituted.

Thank you for joining our first virtual AGM. We have chosen to do this to ensure the safety of our stakeholders. Today's meeting is being held in our auditor's office by webcast and teleconference to enable you, the shareholders, to actively participate in the meeting, while adhering to public health advice.

Shareholders can listen to the meeting, view the slides and ask questions by submitting questions via the chat room facility as part of this broadcast. If you have any questions in relation to a specific resolution then I ask shareholders to submit their questions ahead of the resolution being considered so we can answer as many questions as possible.

I trust you'll allow us some latitude if things don't go as smoothly as possible today.

Online with me today we have in Sydney: Stephe Wilks, Non-executive Director, Giles Bourne our Managing Director and CEO and Ian Mann our Chief Technical Officer. In California we have Vivek Rao, Non-executive Director and in Perth Emmanuel Correia, Company Secretary.

Representatives of our Auditors, Grant Thornton are also present.

Today I will summarise the strategic goals and objectives for BluGlass along with the key milestones achieved over the year.

Giles will then update you on the progress made during the past year in the establishment of our laser diode business and other strategic partnerships and market opportunities. He will also outline the business objectives for the year ahead.

Following this, Ian will present a laser diode product development and technology update.

Finally, after the formal presentations, the Board will answer the questions submitted by investors in advance of the meeting before proceeding with the formal business of the meeting.

Strategy

Our vision of delivering a brighter future through the global commercialisation of our lower temperature RPCVD (remote plasma chemical vapour deposition) technology was firmly in our sights as we embarked on the 2020 financial year.

Our portfolio technology has proven competitive advantages in a diverse range of optical and photonics devices from laser diodes, LEDs and other power electronic and optical devices.

While we continue to pursue multiple applications for the commercialisation of our RPCVD technology the majority of our effort was focused on developing our direct-to-market laser diode product business.

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The gallium nitride (GaN) laser market represents a high value, high margin opportunity for BluGlass. Coupled with RPCVD's unique performance advantages to significantly improve lasing performance, this direct-to-market approach is expected to take the Company to profitability in the shortest timeframe.

We also set out to establish our manufacturing supply chain, scale our RPCVD platform technology to commercial capabilities and prepare for product launches in CY2021.

While the business was focused on the laser diode product strategy, we also continued to work with customers in our foundry business whilst also further developing our strategic partnerships and our IP.

2020 highlights

We are executing on our plans to deliver laser diode products with customer orders and revenues expected in early CY2021.

During the year we set out to:

- Establish our laser diode business unit
- Build out our global supply chain for end-to-end manufacturing of laser products
- Commission our laser diode test facility in New Hampshire, USA
- Develop laser diodes across a suite of products and market applications
- Develop customer relationships and collaborations in the laser diode industry
- Progress our cascade LED and microLED development with collaboration partners for general lighting and other applications; and
- Scale our RPCVD technology to production standards with the commissioning of the BLG-500

Despite the globally challenging business environment presented by the COVID-19 pandemic, international supply chain and customer impacts - the team successfully delivered the major business objectives for the year.

Before COVID hit, we travelled to the US to the 2020 SPIE Photonics West show, where we met with many of our potential laser diode customers. These customers reinforced the significant opportunity that exists in this space, due to the unmet needs, supply chain gaps and lack of flexibility that exists currently.

In October this year, we commenced a laser diode customer contract with Yale University, to contribute laser diode development for the US Defense Advanced Research Projects Agency (known as DAPRA) – LUMOS program. This represents a significant opportunity to develop additional novel laser diode products.

Finance performance

Our financial performance for FY2020 was an operating loss of $5.99m, down from a $14.42m loss in the previous year. Excluding a one-off impairment in FY2019 the operating loss was in line with the previous year of $5.73m.

We had an increase in our foundry revenue for the year, up 54% from $424,000 to $655,830. This was despite the significant impacts in the latter part of the financial year due to COVID shutdowns impacting our customers in the US and Europe. We also reported our first laser diode foundry revenues for the development of custom laser diode designs of $150k.

We expect revenue to increase significantly in FY2021 and for the first time in the company's history we will generate ongoing product revenue.

With our increased R&D expenditure into the development of a portfolio of laser diode products, our R&D tax rebate increased from $2.36m to $2.7m for FY20.

Our gross operating expenditure for the year remained largely in-line with 2019 reducing from $7.7m to $7.5m for FY20. Our net operating expenditure also reduced from $4.9m in 2019 to $4.3m for FY20.

Our $5.8m capital raise completed in March 2020 was well supported by existing and new investors. This has placed BluGlass in a position to execute our immediate business objectives and take the business forward by achieving our main commercial and technical milestones.

In summary, despite the significant global challenges experienced during the year, the business has made strong progress on our four major milestone areas: product development, manufacturing preparedness, technology, and scaling.

The Board are excited about the short-term prospects for the company as management deliver on commercialising our unique technology as we become a product manufacturing and revenue generating business this financial year.

On behalf of the Board, I'd like to thank all of our loyal shareholders for their continued support and belief in the Company, and thank all of the BluGlass team for their enormous efforts and dedication on delivering on our shared vision for the future of our RPCVD technology.

I will now hand over to our Managing Director and CEO, Giles Bourne.

Managing Director's Report

Thank-you James.

I would also like to add my welcome to you all to our 2020 virtual Annual General Meeting. Today I am going to run-through the operational progress of the business during the year and the continuing strategic focus and business objectives for the year ahead.

A platform with multiple go-to-market opportunities

BluGlass' unique RPCVD platform technology has a diverse and growing application in high growth markets. With the recent commissioning of our commercial scale deposition platform, the BLG-500, we have effectively tripled our output capability at our Silverwater manufacturing facility.

Over the last few years, the business was focused on the development of high brightness LED technology and the emerging derivatives of LEDs, such as cascade LEDs and microLEDs and we will continue to pursue these opportunities. More recently we have been developing and gaining expertise in another closely related technology - laser diodes.

A laser diode is in many ways very similar to an LED. They are both light emitting devices. One is a diffuse light emitter and the other a point source of light. Both devices use the same building blocks and technology that we have been developing for a number of years.

This year most of our efforts have been focused on developing our laser diode business and scaling our technology with the help of Aixtron and this has resulted in the successful commissioning of the BLG-500 platform. We also continued to develop our various valuable strategic partnerships in all of our main technology applications.

The laser diode product strategy will enable BluGlass to have greater control of its commercial destiny with the delivery of product into a high growth and high margin market where our installed tool capacity is sufficient to address that market demand.

BluGlass will continue to work on our other applications including high-brightness LEDs, tunnel junction capabilities (which enables both LED and LD products), microLEDs and RPCVD equipment, all of which will be advanced by our technology development into our laser diode product portfolio.

Global laser end-market opportunity

The global end laser markets are significant. There are many different laser diode classes and applications out there, but the market that we are entering is the gallium nitride (GaN) laser diode market with demand driven by growth in four major technology segments:

- Industrial applications
- Medical and biotechnology
- Display markets and
- Automotive

Developing a portfolio of products

BluGlass is developing a range of laser diode products, with several potential customers to meet specific industry needs. Today our potential customers are generally under-served and are looking for new suppliers to provide a range of flexible specifications and also higher-powered products.

Our initial products launched will be standard laser diode designs. We are also simultaneously developing our differentiated laser diode designs to exploit our unique RPCVD tunnel junction technology to produce higher brightness, higher performance laser diodes.

The range of products that we are developing start at 405nm and 420nm products – followed by wavelengths from 450nm to 525nm. Each of these products have a range of applications from cutting and welding, machine vision and sensing to medical devices, DNA sequencing, display technologies and many others.

Product Development Progress

During the year we have been developing several laser diode product designs. The first customer products will be the 405nm and 420nm devices. These two designs are advancing towards sample products through our supply chain. They have been through multiple process steps and are showing good lasing behaviour. In particular, the 405nm design is approaching commercial specifications.

The 450nm design has also recently demonstrated strong results with good lasing behaviour along with good brightness.

There are a range of customers waiting on these samples and prototype products for testing.

Laser diode supply chain development and qualification

I want to talk briefly about the supply chain, as it is important to understand how our product goes all the way from design and epitaxial growth in Australia, through multiple fabrication steps overseas and on to our testing facility in the US and then ultimately to the customer.

When we introduced the laser diode business last year, we set out to secure the end-to-end manufacturing supply chain. During the year we have done this, sourcing multiple vendors in each part of the supply chain, necessary to reduce the risk of future COVID and other supply chain impacts.

A laser diode starts with a bare substrate, which is then deposited on at BluGlass, where we complete the design and epitaxial growth of semiconductor materials (using MOCVD or a combination of MOCVD and RPCVD). The unprocessed wafers are then shipped to our supply chain partners (largely in the US, and some in Europe) and from there it undergoes wafer fabrication - where it is diced, cleaved, coated, contacted and packaged before being ready for testing at our US facility.

Our laser diode test facility in New Hampshire was commissioned in June and is now fully operational. This is where our laser diodes will be reliability tested and subject to burn-in testing prior to being shipped to customers.

This supply chain qualification and establishment has been a challenging task this year in the face of the global COVID-19 impacts. Made more challenging by not being able to physically interact with suppliers and vendors. Thanks to video conferencing we are in regular communication with our supply chain and systematically working through the dynamic qualification of securing our manufacturing capability for the future.

Where we have seen significant challenges with the supply chain, we have brought in alternative suppliers as a back-up. We are becoming increasingly confident in our supply chain readiness for volume manufacturing and are getting closer to the full qualification for manufacturing at scale.

Despite the many steps required to manufacture a laser diode, there are actually multiple customer engagement points that exist throughout the supply chain, and revenue generation is not solely reliant on fully packaged and tested devices that have completed the full supply chain process. Some of our customers will pay for custom laser diode designs at the epi-wafer stage, for example our contract with Yale University to supply epi-wafers of custom designs.

Other customers will engage at different wafer fabrication steps, not requiring optical coating for specific applications or reliability testing, and others will mainly require fully tested devices ready to be purchased per specifications sheets – off the shelf.

Customer segments and needs

Broadly, BluGlass has three laser diode customer segments:

R&D Institution
The R&D Institution for example Universities, military, and commercial institutions. This customer will require highly flexible, bespoke design and development services to develop novel devices and applications.

These contracts will typically require differentiated designs that exploit our unique RPCVD technology advantages. The first example of this is our contract with Yale University and DARPA, developing cutting-edge novel technology.

OEM and System Integrator
The second customer segment, and one of the most significant opportunities for BluGlass, is the OEM and System Integrator segment. These are customers who are currently buying laser diode products and wafers from the limited manufacturers today and integrating them into end systems for applications such as laser-metal machining and copper welding. They typically provide select customers a defined product range at higher volumes (opportunity for repeat orders of a single product).

This market segment is a particular focus for BluGlass, with several customers awaiting sample products. The opportunity here is significant to deliver repeat revenues.

Distributor
The third customer segment is the Distributor. This customer has similar needs and supplier challenges as the OEM and System Integrator; however they provide a large variety of products, covering all wavelengths and power levels to many customers, at lower volumes per product. (Opportunity for many orders of different products and designs).

Laser diode product & supply chain roadmap

When we launched the Laser Diode business in 2019, we set out to develop numerous products that would be released in several iterations over the coming years.

The 405nm and the 420nm laser diodes, will be the initial products that we will be launching with these designs expected to be in sample and prototype testing in early CY2021. This will be closely followed by the 450nm product.

There have been some recent timeline changes with the delivery of sample products moving from the end of this calendar year to early next year. This slight delay is due to recent supply chain disruptions, which have now been resolved. We are confident that this has no material impact on our production timeline and plans for product launches and revenue generation.

It has not been straightforward with our multi-faceted supply chain being remote to us during COVID, and one of our providers relocating. However, we have largely overcome these problems and importantly we are progressing though the product development milestones – which our Chief Technology Officer, Ian Mann will discuss in some detail in his presentation.

Our manufacturing qualification roadmap has also made good progress during the year. We opened our US test facility on schedule in June of this year, and our supply chain qualification milestone, which is tied to the delivery of products ready for customer testing has also shifted very slightly.

Economic scenarios – BluGlass target laser diode revenues

The three building blocks to delivering our revenue targets are: developing our product (first our standard LD designs followed by our differentiated, performance enhancing RPCVD tunnel junction laser diodes); physically launching the product; and building up our customer base and channel partners.

The business will launch products in CY2021 and anticipates delivering growing revenues from next year.
We have looked at various scenarios of market traction in different applications. Additional product launches and higher value (higher performance) product launches anticipated from CY2022 will open significant market opportunities and contribute to our projected baseline and upside revenue growth figures.

Commercial and partner engagements

BluGlass has several strategic partnerships in place in different market segments that continue to be very important to the company, including our cascade LED collaborations with Bridgelux and Luminus and our microLED collaboration with X-Display.

COVID-19 shut-downs unfortunately impacted our cascade LED and microLED development with our partners and customers, however we will continue to work through the milestones as our partners come back online. Ian will give an update on the technology progress in these markets in his presentation.

Significant effort during the year was invested in the commercial scaling of our RPCVD equipment with the retrofit of the AIX-G4 in collaboration with our equipment partner, Aixtron. This collaboration has resulted in the successful commissioning of the largest RPCVD platform to date, the BLG-500. The uniformity results have been very promising from the new platform, with the planetary design working as intended. The BLG-500 is now contributing to our development programmes, including our tunnel junction laser diode program. We will share the output results with Aixtron.

Global patent portfolio - IP update

Our patent portfolio now comprises 75 internationally granted patents across 8 patent families, granted in key semiconductor manufacturing jurisdictions. Our IP strategy is focused on protecting all key breakthroughs through patents, know-how and trademarks.

We are working with leading global patent attorney firms and patent advisors to ensure that we have ring-fenced our unique capabilities and secured our commercial future.

Laser diode business on track to deliver significant revenues

We are strategically focused on delivering on our direct-to-market laser diode business goals and objectives, and we can see the benefits of this strategy coming to bear already, having won a US government sub-contract with Yale University.

Our technology development has made significant progress with our first laser diode products preparing for sample products ahead of being launched early next year. Customers continue to demonstrate their interest in our various products, and they are waiting for us to be able to provide them with samples and products.

Our direct-to-market approach has also allowed BluGlass to secure greater control of our commercialisation and revenue timelines, to the extent that we can have control in this global COVID impacted world. We remain on track to deliver our business objectives in the year ahead.

The markets that we serve continue to transform and grow rapidly and we believe that the unique advantages of the BluGlass are set to have a meaningful impact on these markets and their growth.

This would not be possible without the continued effort and excellence of the talented and dedicated team who make up BluGlass; and you, our shareholders for your continuing support of the Company and our shared vision for our RPCVD technology. Thank-you.

I'll now hand you over to our Chief Technology and Operations Officer, Dr Ian Mann who will take you through the technology update.

Chief Operations and Technology Officer Report

Good morning, my name is Ian Mann and I am the Chief Operations and Technology Officer at BluGlass.

Today I will be presenting an overview and update of our:

- Laser Diode product development and manufacturing activities
- RPCVD tunnel junction laser diode demonstrator
- RPCVD development of microLEDs and tunnel junction LEDs, and
- RPCVD equipment scaling efforts

BluGlass Laser Diode Manufacturing Steps

Many of the manufacturing steps to fabricate LEDs are also used in the production of laser diodes of which BluGlass has, through its various partners, developed a deep understanding of the technical challenges and opportunities. There are several critical differences between GaN based LED and laser diode manufacturing at both the technical and supply chain level.

On the technical side, the quality of the materials used in GaN based laser diodes involves the use of a different substrate: LEDs are typically grown on low cost, readily available, synthetic sapphire wafers, whereas, laser diodes are grown on expensive, high quality, pure GaN substrates. The main advantage of the use of GaN substrates is the very low level of defects present – as laser performance is very sensitive to defects. In addition, the physical handling and cutting of these wafers into small chips is also unique.

The differences are greater on the commercial side, as while LED manufacturing is a very high-volume and well established industry, GaN laser diode manufacturing is a much smaller volume, defined market, which to date does not have a dedicated service industry. In other words, there is no single vendor to send BluGlass' laser diode epi-wafers to, to fabricate into processed and packaged laser diodes ready for customers.

BluGlass has had to develop this supply chain by working closely with multiple vendors, each very experienced in their own GaN, laser, or semiconductor processing specialties.

I will now provide a summary of the key steps undertaken in our current product development and highlight where BluGlass has made progress.

Laser Diode Design and Simulation
BluGlass designs all of its laser diodes, including those that combine MOCVD with RPCVD for tunnel junction laser diodes (and I will talk about this in more detail in the subsequent slides). The design and simulation is vitally important for the technical performance of a final laser. Even subtle changes in the GaN layer compositions can affect the performance and reliability of the end-products. A second feature of simulation is that the combined steps in the manufacturing supply chain each take time to complete so the fewer the number of physical experimental iterations employed as a result of using computer simulations to gain insights, the more successful the product development across fewer iterations.

Epitaxial growth
The supply of high quality GaN substrates is a key input into the first physical step of the laser diode manufacturing process – epitaxial growth. BluGlass has evaluated several GaN substrate vendors and has selected its preferred vendor for the initial manufacturing based on the technical performance observed to date.

BluGlass employs its MOCVD deposition system to grow the various GaN layers (per the laser diode design and simulations) on top of these GaN substrates. This work is presently done on 2" wafers with plans to move to 4" wafers in the future to lower the laser manufacturing cost.

Following the deposition of the GaN materials, the laser wafer is pre-tested with both material measurements and testing of initial device properties - each at the BluGlass facility in Sydney. This device test is the same as we have previously performed and reported on our LED efforts, however, at this stage of wafer and pre-testing there are no lasing properties to be measured until it goes through a number of fabrication steps that are currently all performed overseas with a number of semiconductor manufacturing suppliers selected by BluGlass.

Wafer Fabrication
The GaN laser wafers that have been deposited at BluGlass require two distinct wafer fabrication steps:

Step 1
The initial fabrication, referred to as the front end of microfabrication, is where the laser wafers are patterned into the device structures necessary for concentrating the light generated to achieve a high brightness beam that emits from the edge of the processed device. This fabrication step involves expensive semiconductor equipment and tightly controlled cleanrooms to ensure the small features needed in the structure are precisely fashioned. During this step, patterned metal deposition occurs to provide the electrical contacts needed to operate the device when current is applied.

BluGlass is working with multiple vendors for this critical front-end fabrication step, of which each had to develop, test and verify processes to work for GaN laser diodes.

Step 2
Following the front end of the microfabrication, follows what is called the back end of microfabrication. This step is where several unique processes are deployed for GaN laser diodes compared to LEDs. There are also multiple approaches to this step, and BluGlass is working closely with vendors, including developing proprietary methods, but the output of this step is that the patterned laser wafers are physically thinned down to reduce the thickness of the GaN substrate, undergo another metalisation step to create the electrical contact, and are cut into smaller rectangular size chips in order to be handled easier for the next manufacturing step – cleaving.

In 2020, the suppliers in both of these wafer fabrication steps were significantly impacted by COVID-19.

Cleaving
The type of lasers being manufactured by BluGlass are call edge emitting, in that the laser beam emits from the edge of chip (as opposed to an LED, where the light emits vertically).
To create the 'edge' of the laser, a cleaving process in used. This step involves the careful slicing of the thinned patterned laser chips to have a perfectly clean and smooth interface on the edge of the chip as this is the critical surface that the laser beam will exit the device.
It is at this stage a laser can be measured for its initial performance in a meaningful way. Our lasing results to date are at this stage of the manufacturing but measured at our US test facility in New Hampshire. When the laser diodes are tested, the empirical results are fed back into the next iteration of laser diode design and simulation.

Coating
For the lasers to achieve optimal performance, the two edge surfaces of the long device are coated with specialty optical materials, one reflects the light maximally and the other serves to let the light pass through it while ensuring very little light is lost. It is effectively a mirror surface that allows the light to reflect back and forth but one end is coated to allow the light to transmit through it so as all the emission is at one end. The thin film coatings also protect the GaN edge surface from the environment.

Packaging
The coated laser chips then need to be mounted onto a mechanical and thermally suitable material and physically packaged. This then protects the laser device from the environment and allows for both the electrical connection to the device and the optical output. In the case of high-power lasers, considerable heat is generated, and the packaging strategy is an important aspect of the design to address thermal management. Several of our customer engagements have specific requests for the packaging approach. BluGlass is offering a flexible approach in this regard that has resonated well with customers.

Reliability Testing
For various applications, laser diodes are required to perform for long periods of time, and as such evidence of their performance of operation over time is needed. Referred to as reliability testing, this step is typically required for high-power laser customers – needing over 500 hours of operation under certain test conditions to validate a laser diode design. It should be noted that not all customers require this duration of testing. BluGlass will conduct this testing at its US facility.

While there are many steps required, the complexity does present a strong barrier to entry for many would be competitors, especially as there is no dedicated single vendor offering a laser fabrication service. The performance of a laser device is underpinned by the design of GaN layer structures and the quality of the epitaxial growth - where BluGlass has many years of expertise and the key competitive advantages of low temperature RPCVD to offer differentiated, higher performance devices. The significant effort of the past year to establish our multitude of suppliers, combined with our US presence and test facility – BluGlass is well positioned to manufacture and supply laser diode products globally in 2021.

Laser Diode Update: From R&D to product

There are a number of stages in our product roadmap that provide different industry engagement triggers depending on the customer needs. There are several products that have been identified and each follows a similar path from technical demonstration through to final product manufacturing. I previously explained the various technical manufacturing steps to develop and produce lasers whereas here I will review how the technical outcomes drive the key customer engagement stages. Note the following steps are intended for each individual product so we envision the pipeline being populated with different products at different stages in the sequence.

Stage 1
Technical demonstration refers to the successful implementation of a laser diode design that meets a technical specification that customers are seeking – one typical specification would be the laser brightness for a specific wavelength of light (typically reported in Watts of optical output power). A sufficient demonstration would trigger engagement with a customer and the data would be shared under NDA. Our recent efforts in 405 and 450nm lasers have been shared with select customers and received favorably with requests for prototype samples once we have completed the next manufacturing steps of coating and packaging.

Stages 2
Product samples provided to customers for evaluation and to secure design wins for product orders based on the laser design demonstrated.

Stage 3
The launch of product would follow as soon as successful reliability testing was completed, noting that not all products would have the same duration of testing performed to secure orders.

Stage 4
The final stage is key to BluGlass' growth strategy, through value-added product delivery. Product enhancement or customisation of specific customer devices and applications. BluGlass' unique approach and innovation can enable unique laser integrations and highly differentiated products.

A key differentiator of RPCVD tunnel junction laser diodes is to enhance laser diode designs and deliver the ultimate high power and performance lasers. Other developments are planned in the overall laser diode design as we continue to develop our capabilities where technical and commercial synergies exist to enable the most successful laser applications.

Laser diode technology update

BluGlass is developing a portfolio of laser designs for a wide array of end-products to meet specific customer needs and product trials.

Over the course of the year BluGlass has demonstrated working laser diodes for the various laser diode designs: 405nm, 420nm and 450nm using our standard laser diode approach with MOCVD. These all demonstrated lasing behaviour. These technical demonstrations were achieved through multiple vendors and fabrication approaches for the sequence of manufacturing steps (all testing done following cleaving).

The 405nm design has demonstrated lasers approaching commercial specification for brightness. There have been recent improvements in the 450nm design performance towards required specifications also. The final steps of fabrication (coating, packaging) are required for availability of full product samples to be made available and reliability testing completed prior to a full product launch – each planned for various points in 2021 depending on the application.

In addition to the standard laser diode (fabricated using MOCVD only) BluGlass has advanced the RPCVD TJ laser diode development with recent improvements in LD design and epitaxial quality. We are currently working with the University of New Mexico to fabricate TJ LD demonstrator devices after which we will advance the product development and fabrication with our manufacturing partners.

Tunnel junction approach

Our laser diode product roadmap will require the integration of both our advanced RPCVD technology development and our MOCVD capabilities for the combined deposition so that we can achieve the highest performing laser diodes.

Earlier this year at the SPIE Photonics West conference we presented a paper on one of the BluGlass tunnel junction designs and reported the simulation results and experimental data on the tunnel junction structures. This was part of a collaboration with the University of New Mexico. We have continued to advance the underlying tunnel junction technology using RPCVD but are now tailoring it for laser diode devices. Significant improvements were made with respect to the optical performance of the tunnel junction and laser diode cladding layers as measured internally at BluGlass and with partial laser devices at University of New Mexico.

I would like to briefly recap why we believe the RPCVD tunnel junction approach provides a major differentiation for BluGlass laser diodes. BluGlass has developed a patented method of producing what we call a buried p-GaN layer due to the unique RPCVD process conditions that allow our growth technology to maintain the underlying p-GaN state to what is known as 'activated' – meaning it will allow the semiconductor device to function. In MOCVD, the act of growing GaN material on top of p-GaN causes the p-GaN to become highly resistive – preventing the device from functioning properly.

In addition to the ability to achieve the activated buried p-GaN, the lower growth temperature of RPCVD yields sharper atomic doping profiles compared to MOCVD. The sharper profiles are a direct result of the lower growth temperatures and enable abrupt transitions in composition between two layers. A critical feature of a tunnel junction is an interface between two highly-doped layers with different doping constituents. The sharp transition between these two layers in the RPCVD TJ is an additional differentiator to MOCVD and is vital for creating the most efficient tunnel junction. The low temperature feature is especially relevant for our laser diode structure that required a thick GaN based cladding layer to be grown on top of the tunnel junction. RPCVD is well suited to growing a quality cladding material at low temperature where MOCVD finds this prohibitively difficult.

As is shown in the schematic of the laser diode structure, the light generated from this device is confined to the two edges of the stripe. The confinement of the light into a single axis requires additional layers (called cladding) that are not present in a standard LED structure. Using an RPCVD Tunnel Junction enables the replacement of the conventional p-type (Mg-doped) top layers with an n-type (silicon-doped) top layer and this is expected to significantly improve both the optical and electrical properties of the final device – leading to brighter and more efficient laser diodes.

The bright purple image shows our latest improvement in our tunnel junction laser diode wafers (tested at BluGlass Australia, in our LED quick test set-up) that will be fabricated into laser diodes.

Laser diode customer: Yale & DARPA development program

BluGlass has won a sub-contract from Yale University to provide custom laser-diode development for the US Defense Advanced Research Projects Agency (DARPA) *LUMOS* program.

The LUMOS *(Lasers for Universal Microscale Optical Systems)* program aims to combine for the first-time laser diodes and photonic integrated circuits (PICs) in a single device. The first phase of the paid program represents early laser diode revenue and significant future technical and commercial potential for BluGlass laser diode products.

Lasers are essential for optical communications, remote sensing, manufacturing, and medical applications. Photonic integrated circuits have allowed unprecedented advances in optical systems for a wide range of applications, including LiDAR, signal processing, chip-scale optical clocks, gyros, and data transmission. However, these two technologies are currently limited by the incompatibility of the materials used to create them – silicon photonics are easy to manufacture but are poor light emitters while compound semiconductors enable efficient emitters but are difficult to scale for use in complex integrated circuits.

BluGlass and Yale University are working to combine for the first time, these two technologies to enable high performance lasers and amplifiers with photonic integrated circuits in a single device for applications such as compact optical phased array LiDAR and neuromorphic optical computing. BluGlass' unique technology capabilities provide increased design and manufacturability options to combine nitrides and photonic integrated circuits.

microLED and cascade LED update

BluGlass is working with partners to advance microLEDs for red-green-blue (RGB) applications with good progress in demonstrating RPCVD grown orange and red LEDs and microLEDs for customers.
During the year our microLED customer foundry orders were impacted by COVID-19 lockdowns in both Europe and the USA. Customer orders have recommenced with most customers now.

Efforts in the last several months has been devoted to tunnel junction development for laser diode applications as the main priority. However, our LED development will be able to directly exploit this laser diode tunnel junction work, once matured.

This is because there is strong synergy in the design of the TJ and RPCVD growth across all applications. The main difference in is the fabrication steps following the growth of the LD materials

RPCVD scaling

The BLG-500, BluGlass' commercial scale RPCVD platform completed in collaboration with AIXTRON SE has now successfully completed its performance testing with the demonstration of good working tunnel junction wafers.
The new platform is now contributing to our key tunnel junction development programs - including our laser diode commercialisation roadmap.

The platform has shown really encouraging results for the future, with the planetary design of the system (where the platform has dual axes of rotation to create more uniform deposition during growth) working as intended. The large-scale platform has demonstrated improved uniformity over a 6" wafer size equivalent area compared to the BLG-300 from the very first growth runs. We continue to optimise this further.

This milestone forms a major part of the Company's commercial scaling activities. The BLG-500's large scale will significantly increase BluGlass' RPCVD research and manufacturing capacities

During the year we also won a government grant to develop smarter, faster, more efficient plasma sources for our 300 series deposition platforms. This design will enable customer requested features, including a hybrid growth capability – (both MOCVD and RPCVD growth) in a single platform for the first time. The new design if successful will support scalability on virtually any MOCVD platform in the industry.

The Grant is making good progress with the new plasma design approaching completion for use on the BLG-300. This design is intended to suit uniform deposition for 4" laser diode wafers.

Thank-you

I would also like to thank all our shareholders, stakeholders and customers for their support and to also thank all of the BluGlass technology team, the support staff, and the health and safety committee for their dedicated efforts over the past year with all of its challenges including the global impact of Covid-19.

This announcement has been approved for release by the board.

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