

**first graphene**

Australia's leading graphene company

## ASX Announcement

25 January 2018

# December Quarterly Activities Review

Advanced materials company, First Graphene Limited (FGR) is pleased to provide a review of another important quarter in the Company's development.

### HIGHLIGHTS

- Official opening of the Commercial Graphene Facility (CGF) by Mr Josh Wilson MP, Federal Member for Fremantle.
- First shipment from the CGF.
- Approval of Cooperative Research Centres Project funding for \$1.5m.
- Successful demonstration test of FireStop™ fire retardant.
- Positive initial results on a greener approach towards the fabrication of Graphene Oxide.
- Receipt of research and development refund of \$436,107 and option issue proceeds of \$467,202

### Opening of Commercial Graphene Facility

The Company's Commercial Graphene Facility (CGF) was officially opened by Mr Josh Wilson MP, Federal Member for Fremantle on Thursday 23 November 2017.

The opening was attended by approximately 40 guests, including professors from the three university partners with which FGR collaborates.

In his remarks at the opening FGR Chairman, Warwick Grigor stated "*This Facility represents both the completion of one journey and the commencement of another.*". Mr Grigor went on to explain the first part of the journey had commenced in May 2015 when testing of FGR's was undertaken at the University of Adelaide. "*The tests were done, and they confirmed that not only could graphene be recovered, but of the 50 or more types of graphite that Professor Dusan Losic and his team had tested, the vein graphite gave the best results.*"

Mr Grigor further stated, "*There are two very impressive aspects of this wonderfully innovative venture. The first is the very short time frame in which it has been achieved. The second is the very small expenditure that has been involved. Both are a credit to the resourcefulness of the FGR team, led by our Managing Director, Craig McGuckin. Through careful management and sourcing of equipment for this production facility, management has been able to achieve excellent costs reductions. In many cases these saving have been up to 80%. Rather than accept off-the-shelf quotes from German suppliers, Craig has engaged with manufacturers in China to design and procure equipment at significant savings. That is what good management does for a company.*"

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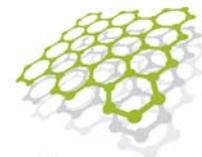
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### ASX Code

FGR

FGROC



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First Graphene Board Members at the unveiling

L to R; Chris Banasik, Peter Youd, Warwick Grigor and Craig McGuckin

In officially opening the facility Mr Wilson remarked " *It really is no exaggeration to say that graphene will likely be one of the defining substances and technologies of the 21st century. It is wonderful that the enormous potential of graphene will be explored and enabled through a production facility here in Henderson; in the Fremantle electorate; in the state of Western Australia. It's exactly the kind of smart, innovative, cutting-edge business that we should be in; that we need to be in.*"



Mr Josh Wilson MP, Federal Member for Fremantle speaking at the official opening.

### First Shipment from Henderson

Within days of the CGF being opened the Company despatched its first sale graphene shipment from the facility. The shipment went to a USA-based construction materials company for testing in cement products. This followed as a result of an enquiry at the IDTechEx Conference in Santa Clara which had been attended by Company management. This shipment demonstrated FGR's ability to meet customer orders from the facility and supply commercial quantities at short notice.



Graphene Product being Prepared for Shipment

Test samples were also despatched to parties in Italy and the UK to use in trials. Feedback from the Italian tests has resulted in FGR preparing sonicated product with a smaller aspect ratio (smaller sheet size) for further test work. These samples will be despatched in the second week of January 2018.

The Henderson facility currently stores in excess of 160 tonnes of high quality Sri Lankan graphite. This would provide adequate feedstock for approximately two years of full time production. More feedstock is being added from purchases under the long term supply contract with the government mine.

### 4th Cooperative Research Centres Project (CRC-P) Funding Round

Application had been made by the Company for funding under the 4<sup>th</sup> CRC-P funding round in August 2017. In December 2017 FGR was advised it had been successful and had been granted \$1.5m, with funding commencing in 2018.

FGR was one of fifteen successful applicants from over seventy submissions made under the funding round. The project funding is to contribute to high performance energy storage alternative to lithium ion batteries, which is being undertaken by FGR for the BEST™ battery and the development of a greener approach to the production of graphene oxide working with Flinders University.

FGR was the first applicant to execute the government Funding Agreement and will receive their first funds in early January 2018.

### Successful demonstration test of FireStop™ fire retardant

Development of the FireStop™ material is being conducted in conjunction with the University of Adelaide as part of the Company's participation as a Tier 1 member of the ARC Research Hub for Graphene Enabled Industry Transformation.

The video link provided with the release on 15 December 2017 demonstrated the dramatic effectiveness of FireStop™ when applied to simple wooden structures. The untreated structure in the video was totally consumed by fire, but the structure treated with the FireStop™ retardant didn't even catch fire after five minutes of trying. Given that fires generally start at specific ignition points, the ability of a graphene-based retardant to stop the ignition is a key feature of the product. The FireStop™ was applied in three coats, was applied by brush and was less than 500 µm thickness.

The relevant characteristic of graphene that this demonstration highlighted was the very high thermal conductivity i.e. the ability to disburse heat away from the source. FGR is highly encouraged by the results of this simple demonstration, which augers well for subsequent, more advanced and scientifically controlled demonstrations that are being undertaken.

### Positive initial results on a greener approach towards the fabrication of Graphene Oxide

FGR has the rights to a 70% interest in the company that owns the intellectual property (IP) rights to the Vortex Fluidic Device (VFD), with the balance of the shares owned by the inventors.

The VFD has the ability to produce graphene from raw graphite and flake graphite concentrates, complementing the electrochemical exfoliation method used in the Graphene Cell that has been installed in the Henderson facility. The VFD can also be used as a secondary processing step to enhance and functionalise graphene products from the Graphene Cell.

Whilst the initial attraction of the VFD was its ability to make graphene, this exciting technology has implications for applications that extend into many aspects of industry, well beyond graphite and graphene. As an example, it is capable of accelerating and increasing the efficiencies of chemical and biochemical reactions which would otherwise be difficult to achieve. It has the potential to redefine organic chemistry.

The ground-breaking science used in the VFD relates to the interaction between centrifugal and gravitational forces which are witnessed when the unit operates at a 45° angle. Unexpected phenomena in chemistry and physics occur, enabling exfoliation of a range of laminar materials in a controlled method, in contrast to high-energy processes such as wet ball milling or high power sonication.

The application of this technology to dynamic thin films with its ability for high heat and mass transfer, shear stress and micro-mixing can lead to the improvement in synthesis of polymers, chemicals and materials.

### Graphene Oxide – Traditional Methods Have Issues

Graphene oxide (GO) can be made by a number of methods but most of them involve extensive use of toxic chemicals such as nitric acid, sulphuric acid and in some instances hydrofluoric acid, this latter acid being extremely dangerous and corrosive. These create environmental issues and added cost.

While GO has the potential to be used in many applications, such as coatings, filters, membranes and in batteries, existing production methods, associated costs and availability of supply have all inhibited the commercial advancement of these applications. Industry is searching for a safer, lower cost production method for GO that is scalable.

**Flinders Test Work on Environmentally Friendly Graphene Oxide**

With still a number of experiments underway, results thus far have established the potential to fabricate GO directly from the graphite ore with a percentage oxidation of approximately 23%.

Using samples of FGR's graphene the experiment was conducted using 30% aqueous hydrogen peroxide under continuous flow, where scalability is addressed at the inception of the science. Hydrogen peroxide was the solvent of choice simply because of the low cost. It is an environmentally benign solvent at low concentrations, widely available and acts as an effective oxidant, facilitating the exfoliation process.

A provisional patent application has now been lodged by Flinders, for the environmentally friendly fabrication of GO using the VFD and related Turbo Thin Film Device (T<sup>2</sup>FD).

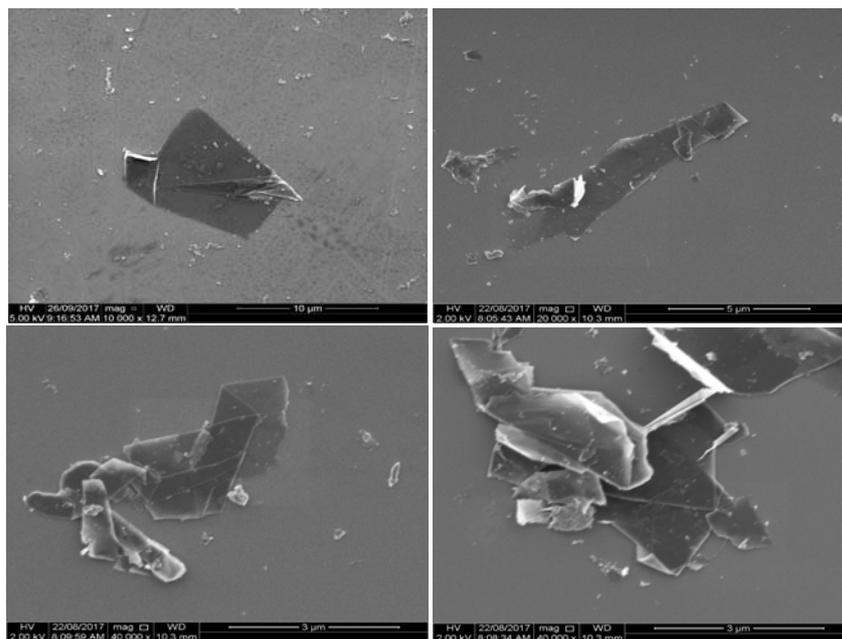


Figure 1: Scanning electron microscopy images of the exfoliated graphene sheets with approximately 23% surface oxidation. The graphene sheets were approximately 7-20nm in thickness.

**BEST™ Battery**

Further work was undertaken on the development of the supercapacitor and prototypes were displayed at the IDTechEx Conference in November.

A detailed update on the development work will be provided in early February.

**Sri Lanka**

Mining continued at Aluketiya during the December quarter.

**Shaft H**

As outlined in the September quarterly release the shaft was sunk to the 42 level. Drive H042273 was driven and now drive H042273SXC will also be driven in a southerly direction away from the shaft, parallel and east of the winze in H036196. A further vein intersect has been encountered and will be developed in parallel with H042273SXC5. The next quarter's production will come from the H042273 strike drives and then from the same area by winzing these veins. A secondary face will be opened/ expanded in H037041 where earlier development drives encountered the graphite vein in ALK29C.

## Shaft J

During the December quarter Shaft J was deepened to provide access to multiple lower level production drives between RL38 to RL49 and an additional three development drives, J030164, J038087 and J049099. Drive J026113SXC45 is being driven to intersect ore identified in drill hole ALK37. For the next quarter will be from both J026113NXC30 and J026113NXC45 (south was where the historical workings were located)

Some historical workings were encountered during the course of drive development.

Ore is being transported and stored at the Company warehouse and will be sorted and packaged at a later date as required.

## Corporate

During the quarter the Company raised \$467,202 from a successful entitlement options issue. It also received \$436,107 from a Federal Government research and development refund.

## Traxys

Traxys has been engaging with potential graphene customers in both the materials and battery spaces. This includes powder suppliers for 3D resin printing, Chinese & Korean battery makers as well as fire retardant solution providers. They expect requests for samples from powder suppliers during the March quarter as well as battery anode makers. There is a growing buzz amongst institutional investors following Samsung's graphene smart phone news and the potential for an ETF fund which makes long investments in physical battery metals to now include graphene. With FGR's product specs now more clearly defined they expect a better sales conversion rate in 2018 as potential buyers will have detailed specs to base discussions on. They are hopeful to achieve and exceed sales targets during 2018.

## The March Quarter Program

FGR has another productive quarter planned with activities including;

- Commissioning of the Commercial Graphene Facility.
- Attendance at the IDTechEx conference in Berlin in mid-April.
- Further testing on FireStop™.
- Further testing on the graphene in concrete additives.
- Continuing work at Flinders University with the Vortex Fluidic Device as we further develop a non-toxic way to produce graphene oxide.

Further details of this quarter's activities can be found in previous ASX releases as detailed below;

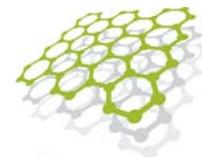
Commenting on this quarterly report, FGR's Managing Director Craig McGuckin said

*"This has been an extremely productive quarter with significant advances in the Company's graphene research work at the three universities and the opening of the Commercial Graphene Facility. The latter event focussed national attention on the fact that First Graphene is Australia's premier advanced materials company.*

*We look forward to another very busy quarter in March 2018."*

### Significant December Quarter Announcements

Date	Subject Matter	URL Link
20 Oct 2017	Dr Andy Goodwin's interview with FNN.	<a href="https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=301">https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=301</a>
23 Oct 2017	Graphene Technology Update	<a href="https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=289">https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=289</a>
21 Nov 2017	IDTechEx Conference Attendance	<a href="https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=295">https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=295</a>
27 Nov 2017	Official Opening of Commercial Graphene Facility	<a href="https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=291">https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=291</a>
5 Dec 2017	First Shipment from Henderson Facility	<a href="https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=309">https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=309</a>
13 Dec 2017	A Greener Approach Towards the Fabrication of Graphene Oxide (GO)	<a href="https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=310">https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=310</a>
15 Dec 2017	Demonstration Video of FireStop™ Effectiveness	<a href="https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=311">https://www.firstgraphite.com.au/investor-relations/asx-announcements?task=document.viewdoc&amp;id=311</a>



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#### *About First Graphene Ltd (ASX: FGR)*

*First Graphene produces high quality graphene from high grade Sri Lankan vein graphite.*

*First Graphene seeks to develop graphene production methods and acquire graphene related intellectual property which can provide further revenue related opportunities.*

#### *About Graphene*

*Graphene, the well-publicised and now famous two-dimensional carbon allotrope, is as versatile a material as any discovered on Earth. Its amazing properties as the lightest and strongest material, compared with its ability to conduct heat and electricity better than anything else, means it can be integrated into a huge number of applications. Initially this will mean graphene is used to help improve the performance and efficiency of current materials and substances, but in the future, it will also be developed in conjunction with other two-dimensional (2D) crystals to create some even more amazing compounds to suit an even wider range of applications.*

*One area of research which is being very highly studied is energy storage. Currently, scientists are working on enhancing the capabilities of lithium ion batteries (by incorporating graphene as an anode) to offer much higher storage capacities with much better longevity and charge rate. Also, graphene is being studied and developed to be used in the manufacture of supercapacitors which can be charged very quickly, yet also be able to store a large amount of electricity.*

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