

Vortex Fluidic Device gGO™ Update

HIGHLIGHTS

- **VFD produced gGO™ improves efficiency of organic photovoltaic solar cells by 8.5 %**
- **gGO™ displays highly selective UV photoluminescence**
- **Progress being made in optimising yield and scaling up the proprietary Vortex Fluidics Process Technology**

First Graphene Ltd ("ASX: **FGR**" or "the **Company**"), is pleased to provide an update on work conducted with subsidiary 2D Fluidics Pty Ltd ("**2D Fluidics**") using its Vortex Fluidics Device ("**VFD**"), with progress in establishing yield, scale and suitability of the produced gGO™ material.

Improved Power Conversion Efficiency in Organic Photovoltaic Solar Cells

Researchers at the Flinders Institute for Nanoscale Science and Technology have demonstrated the Green Graphene Oxide (gGO™) produced from the VFD gives an improvement in the Power Conversion Efficiency (PCE) of organic photovoltaic (OPV) cells. The PCE is a measure of the amount of solar energy which is converted to electrical energy in the OPV cell.

The initial data shows the addition of a relatively small amount of gGO™ as a layer in an OPV cell increased the power conversion efficiency by 8%, taking it into a range which makes it attractive for further research towards the next generation of OPV cells. The efficiency improvement is understood to occur due to the gGO™ decreasing the work function of the active layer.

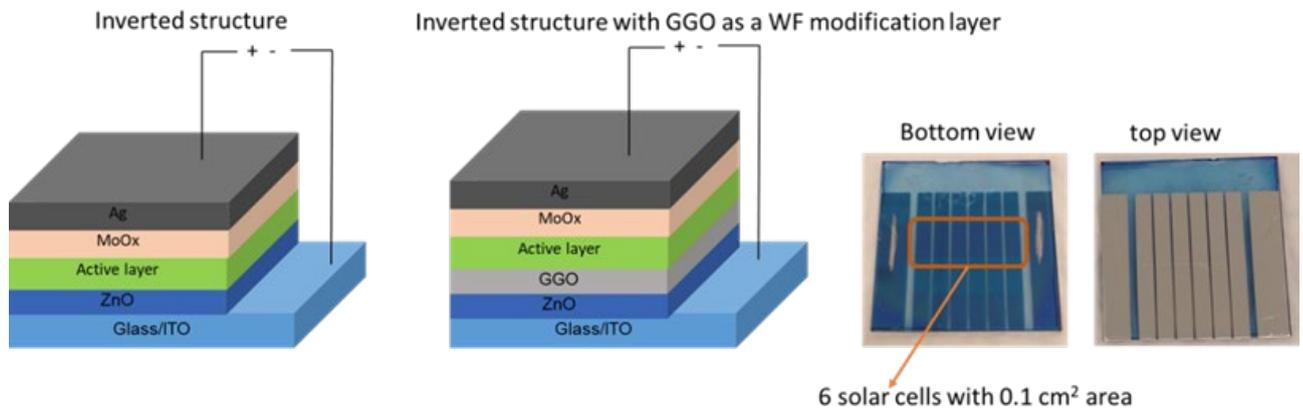


Figure 1: Schematic of the Organic Photovoltaic Cell design

The next step will see the researchers further improve the system, by improving the gGO™ formulation methods as well as attempting to remove the ZnO layer from the cell, to make a flexible organic photovoltaic cell which can be used for a wider range of applications, including wearable sensors.

Green Graphene Oxide Used to Tune UV Light

A separate study with researchers at Queensland University has shown that Green Graphene Oxide (gGO™) is photoluminescent, with narrow absorption and emissions bands confirming the presence of ordered sp² domains with a relatively small size. This indicates the VFD can generate pristine graphene, which is separated by functionalised areas, giving it a specific electronic structure, which accounts for the photoluminescence.

The researchers have observed absorption of light at 277 nm with corresponding emissions at 378 nm and 395 nm. This behaviour is not seen in “traditional” graphene oxide produced using Hummer’s method. However, it is seen in carbon quantum dots, which has a more regular structure. This demonstrates 2D Fluidics’ capability to consistently produce Green Graphene Oxide with controlled surface oxidation levels and a consistent structure.

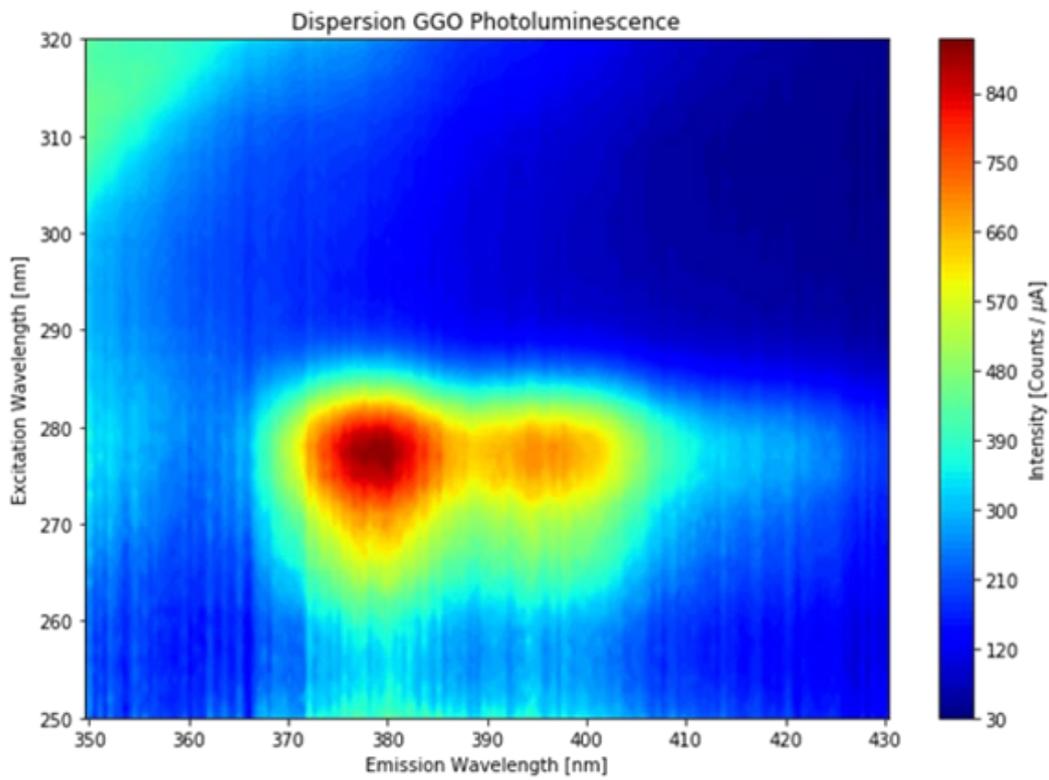


Figure 2: Green Graphene Oxide – photoluminescence spectrum

The preliminary results suggest green graphene oxide may be suitable as a carbon-based additive for applications where more toxic, metal-based quantum dots are currently utilised. This is dependent on further applications testing. However, it could enable gGO™ to be considered for a range of applications such as biosensing, solar cell fabrication and energy storage.

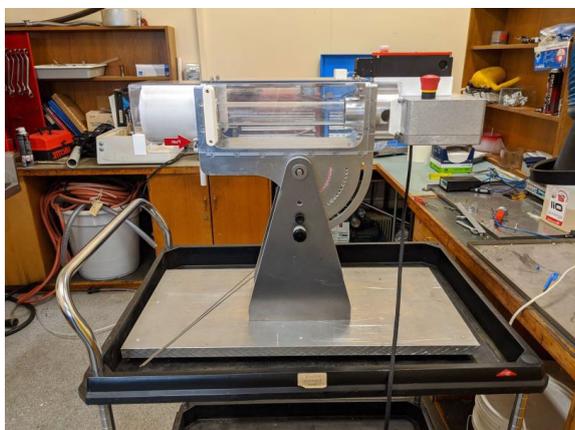
Scale Up of the Vortex Fluidics Unit

The combined FGR and 2D Fluidics team have been working on the scale up of the VFD and understanding and optimising the process yield.

Results from ongoing Mass Balance Trials conducted at the Graphene Engineering Innovation Centre (GEIC) in Manchester, United Kingdom, in conjunction with Flinders University, indicate a process yield of 28% at present, with identified areas of improvement to fully optimise the process. In conjunction with this work, the 2D Fluidics team at Flinders University have successfully scaled up the original VFD design from 20mm to 50mm giving a throughput improvement of 15 times (1,500%.)

Large 50 mm Diameter VFD

For the purpose of establishing scalability, exfoliation experiments carried out in the 20 mm VFD was translated to the 50 mm VFD. The 50 mm VFD includes similar features to the 20 mm VFD; (a) variable rotational speed (500 rpm - 9000 rpm), (b) variable tilt angle (0-90 degrees) and (c) confined mode and continuous flow capabilities (maximum volume capabilities per processing time 30mL compared to 20 mm VFD which can hold a maximum volume of 2mL). Preliminary experiments included (a) efficiency of exfoliation process by varying the rotational speed (2000 rpm, 3000 rpm, 4000 rpm, 6500 rpm). Here, we used 10 mg/mL of graphite ore with a particle size of 500 micron dispersed in 30% aqueous H₂O₂



Large 50mm Vortex Fluidic Device at Flinders University

Both teams have already identified improvements which can be made to the system to potentially enhance yield and underwrite the further potential scale up of the VFD.

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About First Graphene Ltd (ASX: FGR)

First Graphene Ltd. is the leading supplier of high-performing, graphene products. The company has a robust manufacturing platform based upon captive supply of high-purity raw materials and an established 100 tonne/year graphene production capacity. Commercial applications are now being progressed in composites, elastomers, fire retardancy, construction and energy storage.

First Graphene Ltd. is publicly listed in Australia (ASX:FGR) and has a primary manufacturing base in Henderson, near Perth, WA. The company is incorporated in the UK as First Graphene (UK) Ltd. and is a Tier 1 partner at the Graphene Engineering and Innovation Centre (GEIC), Manchester, UK.

PureGRAPH® Range of Products

PureGRAPH® graphene powders are available in tonnage volumes with lateral platelet sizes of 20µm, 10µm and 5µm. The products are high performing additives, characterised by their high quality and ease of use.

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With authority of the board, this announcement has been authorised for release, by Peter R. Youd Director, Chief Financial Officer and Company Secretary.