

09 December 2020

2D Fluidics Update on Energy Storage Materials

HIGHLIGHTS

- **VFD produces consistent size Graphene/Fullerene composite spheres**
- **Graphene/Fullerene composite spheres < 1µm have potential as improved energy storage anode materials**
- **The size of the composite spheres can be optimised through the VFD processing technology**
- **Protected by global patent pending IP, which is currently under national phase examination**

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**”) to produce graphene-wrapped fullerene composite spheres which have the potential to be used as an “all carbon” energy storage material.

Currently, spherical graphite (SPG) is a crucial ingredient to the efficient operation of lithium-ion batteries (LiB). Spherical graphite is the key component of the anode of a LiB which without, the LiB would not function. Historically SPG has been derived from flake natural graphite.

The global production of spherical graphite is currently dominated by China, which uses the mechanical shaping and hydrofluoric acid purification techniques to produce purified spherical graphite. With the transition of the world to a clean, green energy platform many LiB manufacturers are actively seeking alternative supply options that offer better efficiencies. A number of companies around the world are researching alternatives graphite products to traditional spherical graphite as a basis for developing graphite mines, but graphene appears to offer something beyond graphite owing to its advanced properties.

FGR is in a unique position to produce a graphene-based spherical product by employing the VFD technology. Research to date has shown the graphene fullerenes could be a suitable replacement for spheroid graphite used in anode manufacturing. The Company's manufacturing process may have the potential to offer improvements in performance, which is a constant issue for battery manufacturers. The fullerenes have potential to enhance both lithium-ion batteries and supercapacitors.

As with all of the other alternatives being worked on by a range of companies, the commerciality and scalability of the production process is dependent upon continuing research and development. Research and development work is being undertaken in the UK in FGR's laboratory at the Graphene Engineering Innovation Centre, at the University of Manchester and with the University of Warwick.

Composite Fullerene C₆₀ Graphite Spheres

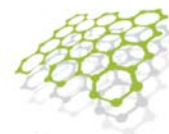
Using both the original and the scaled up VFD units, 2D Fluidics has successfully replicated the production of composite C₆₀ / graphene spheres. This work is reported in the publication "*High Yield Continuous-Flow Synthesis of Spheroidal C₆₀@graphene composites as supercapacitors*".¹ C₆₀ refers to the fullerene form of carbon. It consists of a soccer-ball-shaped cluster of sixty carbon atoms. The graphene-wrapped fullerene composites have a "pom-pom" shape and are known for their unique energy levels and high value of electron affinity energy. They have shown high capacitance when tested in an electrochemical cell by Flinders University.

Importantly, the VFD can produce this material directly from FGR supplied graphite material (D₉₀ 500µm). The size of the spheres produced by the 20mm VFD were 1.5–3.0 µm. In the 50mm VFD, using the same raw material production volume was increased and the spheres were ≤ 1 µm.

The production of the "pom-pom" shaped graphene-wrapped fullerene spheres has been replicated at FGR's UK laboratory, using similar operating conditions. The controlled manufacture of this new product could give the potential performance improvements when compared to the restricted sizing of conventional spherical graphite used as an anode material.

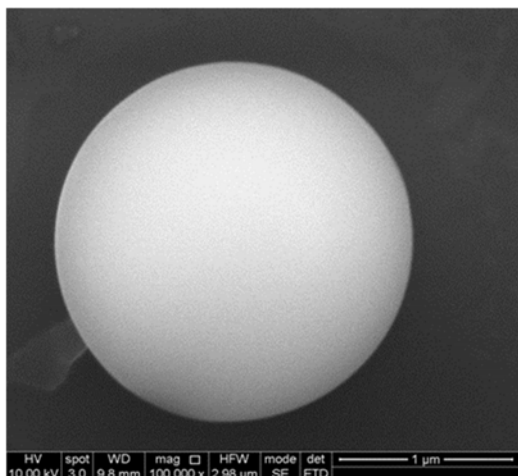
Further experiments in the 50 mm VFD at lower rotational speed will be conducted to demonstrate the ability to control the size of the spheres, test scalability of process and calculate production yield.

¹ Raston *et al*, High-Yield Continuous-Flow Synthesis of Spheroidal C₆₀@Graphene Composites as Supercapacitors, *ACS Omega* **2019**, 4, 19279–19286

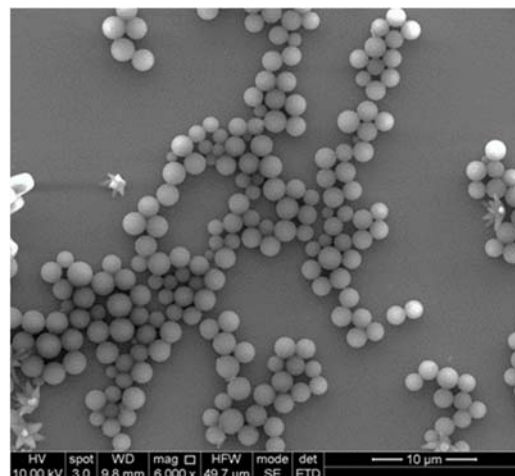


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FGR are producing sufficient quantities of these novel materials for evaluation in energy storage applications at leading United Kingdom based universities, such as the University of Warwick. Of particular interest is the use of these materials as active materials in supercapacitors and also as Lithium-ion battery anodes.



Graphene Sphere "pom-pom" - 1 μm



Spheres from VFD $\leq 1 \mu\text{m}$

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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.