ASX Announcement

8 January 2018

Project Development of Graphene-Based Industrial Products – Concrete

HIGHLIGHTS

- Initial results show FGR's standard graphene improves compressive and tensile strength of concrete.
- Ability to arrest crack propagation.
- Potential to minimise, or even replace the use of steel bars and fibre reinforcements.
- Further test work will be conducted at the University of Adelaide, including a focus on "smart concrete" and high value, ultra-high performance concrete.

Advanced materials company, First Graphene Limited ("FGR" or "the Company") (ASX: FGR) is pleased to provide an update on its work with University of Adelaide (UoA) on graphene within industrial building products.

Background

FGR is the lead industry partner in the Australian Research Council (ARC) Graphene Hub, designed to bring together scientists and industry for the development of industrial applications for commercialisation. Within the hub one of the three streams of research by FGR is the use of graphene in industrial products, and in particular building materials such as cement.

Graphene in Concrete

Experiments conducted in other jurisdictions have focussed on the use of graphene oxide (GO) being added to concrete to improve both compressive and tensile strength. GO is considerably more expensive than graphene and available only in limited quantities. Therefore, any experiments involving GO would be difficult to commercialise. The hydrophilic and high resistivity nature of GO also limits its applications in things such as 'smart' cement.

Due to the high aspect ratio of nano-reinforcements such as graphene and carbon nanotubes, they have the ability to arrest the crack propagation (by controlling the nano-sized cracks before they form micro-sized cracks) and hence greatly improve peak toughness, making them more effective than even conventional steel bar or fibre reinforcements.

First Graphene Limited

ACN 007 870 760
ABN 50 007 870 760

Registered Office
Suite 3
9 Hampden Road
Nedlands WA 6009

Tel: +61 1300 660 448
Fax: +61 1300 855 044

Directors
Warwick Grigor
Craig McGuckin
Peter R Youd
Chris Banasik

Company Secretary
Peter R Youd

E: info@firstgraphene.com.au
W: firstgraphene.com.au

ASX Code
FGR
FGROC

Premium Concrete Products – Smart Cement

Ultra-High Performance Concrete (UHPC) operates at such a high-performance level that it competes with steel rather than regular concrete grades. Advantages include lower lead times compared to steel. UHPC can cost in excess of $500/tonne, with enhancements such as micro-reinforcements further increasing the price. Due to the immense importance of compression strength and other factors such as blast, ballistic and earthquake resistance, additive premiums can be significant. UHPC is over an order of magnitude more expensive than regular concrete, but in an environment where material usage and weight are such essential considerations, it can actually be cheaper to use the more expensive grades in the long run, especially factoring in the reduced maintenance costs incurred by UHPC.

The UoA is testing FGR graphene, with the aim of making "smart cement" with conductive graphene flakes which may;

i. address the concerns of cracking and corrosion, and

ii. provide conductivity for better monitoring the health of concrete structures.

The first test results indicate the addition of 0.03% standard graphene is the optimal quantity of graphene from the test conducted to date, showing a 22 - 23 % increase in compressive and tensile strength, respectively. The addition of more standard graphene does not increase or decrease the strength of the concrete material when compared to the control in this test work.

Conclusions – Promising Results with Favourable Economics

The initial work has yielded very promising results with very small amounts of FGR graphene required to greatly increase the strength of the materials. Determining the optimum mixing methods and concentration to develop a consistent material will be the key to further developing this project.

Future work

The focus of the next stage of the work will be trialling other concentrations of graphene in concrete, specifically the 0.01 and 0.1% graphene, and optimisation of the mixing procedures. New methods of incorporating graphene into the concrete mixture will be trialled. The graphene provided by FGR will have a range of aspect ratios (smaller sheet sizes) and will be tested over the full range of concentrations. It is anticipated this material will better disperse within the concrete mixture and therefore provide further mechanical strength improvements.

The concrete admixtures market is estimated to be worth US$18.10bn by 2020. The drivers identified for the concrete admixtures demand are growing infrastructure requirements in developing economies, improving economics of construction, and shifting preferences of population towards urbanisation.

Commenting on these results, FGR's Managing Director Craig McGuckin said

"These initial results are very encouraging, particularly as they are the first unoptimised experiment utilising extremely low graphene concentrations on this node conducted under the ARC Hub's frame work. We anticipate further improvements with future tests and look forward to keeping shareholders updated as we progress."

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.

For further information, please contact

Craig McGuckin

Managing Director
First Graphene Limited
+ 61 1300 660 448

Warwick Grigor

Non-Executive Chairman
First Graphene Limited
+61 417 863187