

24th January 2022

University of Wollongong study confirms improvements in concrete and repair mortar durability

HIGHLIGHTS

- **University of Wollongong research program indicates major improvement in sulphate resistance using PureGRAPH® in structural concrete and repair-mortar systems**
- **Results combined with improvement in compressive strength demonstrate PureGRAPH® to be superior multi-functional additive for concrete and mortar in critical infrastructure applications**
- **Provides potential opportunity to participate in global market for mega-infrastructure water projects**
- **First Graphene engaging utility and infrastructure providers to develop advanced mortar and concrete applications with view to improve asset longevity**

First Graphene (ASX:FGR; "First Graphene" or "the Company") is pleased to announce the findings from a study by the University of Wollongong (UoW) into enhancing properties of mortar and concrete used in corrosive water environments.

The issue with sulphates and corrosive water environments

Deterioration of concrete products used in water-related infrastructure projects is an ever-present issue that results in high maintenance and repair costs for the responsible authorities. Achieving better resistance to sulphates and other corrosive chemicals that damage concrete infrastructure is seen as a high priority by the industry.

First Graphene believes the addition of its graphene additives could provide significant improvements in the performance and durability of concrete-based piping and infrastructure. The work being undertaken by the UoW has been very supportive of this view.

Work being undertaken by the University of Wollongong

In order to generate scientific-based test results in pursuit of this opportunity, the Company initiated an A\$6,600 paid research program, being conducted by the UoW, using First Graphene's PureGRAPH® graphene products to show it can enhance the properties of mortar and concrete. Conducted by the University's School of Civil, Mining and Environmental Engineering, the research aims to understand how the addition of graphene platelets to mortar and concrete systems can enhance a range of physical, chemical and physio-chemical properties.

Cement mortar is widely used as a binding agent in concrete systems. Significantly, several studies have shown graphene nanoplatelet additions of less than 0.1% can significantly enhance mortar properties.

Extensive studies by the University of Wollongong, which is partnering with an Australian

domestic water, sewerage and drainage statutory authority, confirm the addition of small amounts of graphene enhances the 28-day compressive strength of both concrete and mortar systems by 10% and 20% respectively. Better improvements are expected to be achieved in longer time trials.

The project's initial test results have confirmed the addition of PureGRAPH® reduces the apparent volume of permeable voids (permeability) of repair mortar and concrete systems by 19% and 12% respectively, while also reducing sulphate expansion in concrete by 64%, and 56% in the repair mortar.

The research has been underway since August 2021 and is now in peer review phase. It is expected to be published in a peer reviewed journal in the second half of 2022.

Commercial potential

Significant reductions in permeability and sulphate expansion are consistent with higher levels of concrete durability due to reduced degradation from harmful acid sulphates. This is expected to give a materially significant, longer service life to concrete assets and reduced need for concrete repairs.

The research shows promising signs for application in concrete infrastructure in environments requiring high levels of durability, such as wastewater collection and treatment plants, and coastal ports. This is especially relevant because the degradation of concrete wastewater systems results in multi-million-dollar concrete repair and replacement challenges for water treatment providers.

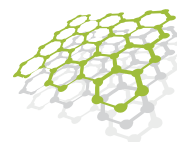
First Graphene is now engaging large utility providers and infrastructure developers to further develop these advanced mortar and concrete applications that can have a significant impact on the longevity of major infrastructure development projects.

While there are no immediate commercial opportunities or an assessment of economic impact, this research opens the door for First Graphene to another new global market segment.

First Graphene Managing Director and CEO Michael Bell said: *"These are encouraging results demonstrating graphene-enhanced mortar and concrete systems can potentially be used in applications requiring serious durability such as wastewater treatment infrastructure and structures exposed to seawater. This development further justifies our focus in cement and concrete systems and compliments the CO₂-reducing capability of PureGRAPH® in this segment. We look forward to continuing the development of graphene-based products with the University of Wollongong and key industry partners."*

University of Wollongong lead researcher Associate Professor Guangming Jiang said: *"Our Research program is progressing well. We have received good support from First Graphene and are excited to publish our results, which will inform future research in this important area. We will work with First Graphene and other potential industry partners to seek further research funding from various sources including the Australian Research Council."*

ASX ANNOUNCEMENT



first graphene

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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 and PureGRAPH® AQUA pastes with lateral platelet sizes of 50µm, 20µm, 10µm and 5µm, as well as PureGRAPH® masterbatches and admixtures, are available in tonnage volumes. 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 Aditya Asthana, Chief Financial Officer and Company Secretary.