

29<sup>th</sup> November 2023

# Accelerating commercialisation of graphene decarbonisation products into an expanding range of cement companies

## Highlights

### Breedon trials continue to impress

- Phase Two cement trials with Breedon Cement complete, following successful initial trials which demonstrated 15% CO<sub>2</sub> emission reduction
- Development & Commercialisation Agreement with Breedon secured

### Extending coverage to additional cement companies

- First Graphene's global reach expands as trials continue with Holcim NZ and Thai cement producer Siam City Cement
- GtM Action commences trials of PureGRAPH<sup>®</sup>-enhanced sand, with the aim of improving incorporation of graphene into dry mix cement
- Collaboration begins with Swedish company to determine benefits of graphene in minerals sector

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First Graphene Limited (ASX: FGR; "First Graphene" or "the Company") is pleased to provide an update on its growing footprint in the green cement and concrete sector.

## Phase Two trials successfully executed with Breedon Cement Ltd

The second phase of graphene-enhanced cement trials, in collaboration with leading UK cement producer Breedon Cement Ltd ("Breedon") at its Hope Cement Works, have concluded. This followed successful Phase One trials that achieved up to 10% increase in the cement's early-stage compressive strength and a 15% reduction in CO<sub>2</sub> emissions during the manufacturing process.

The material made during the Phase One trials also successfully met performance criteria in the end systems, demonstrating the viability of producing graphene-enhanced cement at industrial scale. This is a major trial milestone, reinforcing First Graphene's PureGRAPH<sup>®</sup> product as a high-performing additive for cement, delivering associated mechanical performance and decarbonisation benefits.

The Phase Two trials used four tonnes of grinding aid containing PureGRAPH<sup>®</sup> to produce an additional 600 tonnes of graphene-enhanced cement at the production scale. The focus was on the optimisation of dosing methods at an increased graphene loading level, with the resulting formulation change in the grinding aid. This stage builds on the learnings from earlier work, with

results expected in January 2024 which will be used to compare performance to the Phase One trials.

Initial results released from the Phase One trials, which included use of cement produced in the construction of a high-volume car wash-down facility, has seen First Graphene enter early-stage discussions with a UK Government agency to optimise graphene-enhanced cement's performance to meet its needs, focusing on early-stage strength gain.

Ongoing collaboration with Breedon is now supported through the signing of a Development and Commercialisation Agreement with First Graphene, setting out how the companies will work together to develop a range of graphene-enhanced solutions designed to reduce Breedon's carbon emissions footprint associated with cement production.

The decision to partner with the UK's largest cement producer is a significant step forward in First Graphene's commercialisation strategy for its range of PureGRAPH® products, given Breedon's production of more than two million tonnes of cement annually and the growing global demand for green cement.



Figure 1: FGR Process Engineering Manager Paul Ladislaus at the Breedon Hope Cement Works facility conducting the Phase Two trials.

## Performance tests continue at Holcim NZ

First Graphene representatives visited Holcim (New Zealand) Ltd, (“Holcim NZ”), in Auckland following the New Zealand Cement and Concrete Conference, to view the global cement producer’s Low-Carbon Cement Replacement Facility.

Holcim NZ has been testing First Graphene’s PureGRAPH® product as an additive to increase the performance of Supplementary Cementitious Materials (SCM), with the aim of reducing CO<sub>2</sub> emissions in the sector and increasing performance of cement blends to extend the range of applications. Currently, Holcim NZ are working on identifying the optimum PureGRAPH® product to achieve this goal, and the corresponding addition method.

Holcim NZ is part of the Holcim group, a global leader in innovative and sustainable building solutions, with an annual turnover of circa AUD\$50 billion. Holcim is driven by its purpose to build progress for people and the planet, and strives to decarbonise the construction sector by offering its clients a broad range of low-carbon and circular economy solutions.

The trials and strengthening relationship offer a significant opportunity to further expand the prominence of First Graphene’s PureGRAPH® solutions with one of the world’s leading innovators in the sector. This lays the foundations for further commercial opportunities to arise and bolsters the Company’s credibility in the industry.



Figure 2: FGR Commercial Manager Neil Armstrong, GtM Action MD Mike Ogle and Holcim National Manager David Darlow at the Holcim Low-Carbon Cement Replacement Facility in New Zealand.

## **Trials begin with one of Thailand's largest cement companies**

First Graphene has commenced collaborative trials with Thailand-headquartered Siam City Cement Public Company Limited ("Siam City Cement" or "SCCC"), targeting lower clinker content in their cement products while maintaining good cement quality. Lab-scale testing is currently underway, with the aim of determining the ideal PureGRAPH® product for their cement composition.

Siam City Cement Thailand has been providing world-class construction materials and services to the country and broader region for more than 50 years. Aware of global warming problems, SCCC established a roadmap to accelerate CO<sub>2</sub> emission reduction. To achieve this ambition, there are necessary changes to bring in. One of the key initiatives is to increase clinker substitution with SCMs (Supplementary Cementing Materials).

This development is significant for First Graphene as it provides the opportunity to strengthen relationships and bolster awareness of the Company's solutions among high-consumption and in-demand cement and concrete markets.

## **Graphene-enhanced sand tested by GtM Action**

First Graphene's commercial partner GtM Action ("GtM") recently commenced trials in New Zealand of PureGRAPH®-enhanced sand, with the aim of validating an improved method to incorporating graphene into dry mix cement.

First stage trials are designed to investigate if sand as a graphene carrier would practically work in GtM's current cement production process, and results are expected imminently. Future stages have been designed to test the mechanical performance of graphene-enhanced sand in concrete slabs.

Trials are ongoing to assess whether graphene-enhanced sand could be easier to handle than liquid alternatives, therefore providing a more readily accessible product for the slabs that GtM manufactures. The slabs are used as insulation, protecting ceramics from furnaces during construction, and while it is a specialty application, the trial allows PureGRAPH®-enhanced sand testing in a commercial project.



Figure 3: Graphene-enhanced cement slabs to be used as insulation panels and tested in a commercial project.

## Optimisation trials with LKAB

First Graphene has commenced early-stage discussions with LKAB Minerals, which is the international industrial minerals division of LKAB. LKAB is an international mining and minerals group that offers sustainable iron ore, minerals, and special products. The specific focus is on the optimisation of their granulated blast furnace slag (GBFS) processing facility in the UK.

The intention is to assess the effectiveness of graphene as both a grinding aid and additive in granulated GBFS-based binders. Initial work will be conducted at the laboratory-scale, and a successful outcome, which demonstrates no adverse impact on customers, would be an enabler to a full production scale trial.

## Graphene-enhanced cement Intellectual Property portfolio development

First Graphene continues to make progress in protecting the Company's PureGRAPH® brand for cement and concrete applications. Trademarks for PureGRAPH-CEM™ have been granted in the EU, Australia, and the UK. This is an important milestone in the protection of the PureGRAPH® brand as a globally recognised additive in the construction industry.

## Presenting graphene benefits on the global stage

First Graphene Commercial Manager Neil Armstrong recently exhibited at the ConcreteNZ Conference in New Zealand, providing a global stage for the Company to present the benefits of graphene-enhanced cement and First Graphene's product line.

Along with the Company's strategic partner GtM Action, First Graphene took the opportunity to build on global relationships and connect with relevant stakeholders at the conference, where discussions primarily focused on lower-carbon solutions for the cement and concrete industry.

## First Graphene Managing Director and CEO Michael Bell said:

*"There has been a significant increase in activity for First Graphene as we advance and solidify our position in the cement and concrete industry.*

*This is a sector increasingly searching for alternative solutions to enhance its industrial materials performance and reduce carbon emissions from production processes.*

*As a result, FGR is rapidly expanding international collaborations it has in the research and development field, as well as opportunities to scale up commercialisation of our product.*

*This is an exciting time for the Company as our commercialisation strategy continues to gain traction, evidenced by recent milestones and the fact we are now collaborating with some of the world's most prominent and innovative organisations in the sector.*

*I look forward to providing shareholders with further updates on our involvement in the fast-growing cement and concrete segment."*

**This release has been approved for release by the board.**

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

*First Graphene Limited is focused on the development of advanced materials to help industry improve. The Company is a leading supplier of graphitic materials and product formulations with a specific commercial focus on large, high-growth global markets including cement and concrete; composites and plastics; coatings, adhesives, silicones and elastomers (CASE); and energy storage applications.*

*One of the key benefits of these advanced materials is the reduction of carbon dioxide emissions, whether directly through a reduction in output of these harmful greenhouse gases or lower energy usage requirements in manufacturing, or indirectly due to enhanced performance characteristics and extending the usable life of products.*

*First Graphene has a robust manufacturing platform based on captive and abundant supply of high-purity raw materials, and readily scalable technologies to meet growing market demand. As well as being the world's leading supplier of its own high performance PureGRAPH® graphene product range, the Company works with multiple industry partners around the world as a supplier of graphitic materials and partner to research, develop, test and facilitate the commercial marketing of a wide range of sector-specific chemical solutions.*

*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, where it has a strong marketing and R&D capability.*