

### **INVEST – Stuttgart**

**PureGRAPH®** - revolutionising material performance and providing low carbon solutions for a greener future

26<sup>th</sup> - 27<sup>th</sup> April 2024



### **About First Graphene**

#### **FIRSTGRAPHENE**

- Leading developer and manufacturer of high-quality and commercial-scale graphene products, called PureGRAPH<sup>®</sup>
- PureGRAPH<sup>®</sup> is an additive that enhances material performance and properties of customers' products, enabling cost-effective solutions to optimise energy capabilities and reduce emissions
- Commercial applications of PureGRAPH<sup>®</sup> include construction and infrastructure, energy and storage, and industrial materials industries
- World-class manufacturing facility at Henderson, Western Australia, with production capacity of 100tpa and readily scalable technology to cater for growing demand
- Development and commercialisation agreement signed with UK's largest cement manufacturer, Breedon Group (Oct 2023), following successful 'green cement' trials
- Tier 2 partner at the Graphene Engineering and Innovation Centre (GEIC), with major R&D capability in Manchester, UK



Manufacturing facility at Henderson, WA



Established and operational production facility



PureGRAPH<sup>®</sup> graphene products

### **Remarkable properties of graphene**

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Adding graphene enables significant performance improvements to just about any product and material



### **PureGRAPH® products**

- **PureGRAPH**<sup>®</sup> is a **high performing graphene additive**, used across many consumer and industrial sectors
- Characterised by its large platelet size, high aspect ratio and low defect levels
- Batch-to-batch consistency ensured through strict, in-house quality control testing, and established repeatable manufacturing process
- Designed to be dispersed in a broad range of materials, including plastics, composites, rubber and elastomers, cement and concrete, and inks and coatings
- Product range includes a growing list of masterbatch (MB) additives, with custom MB available upon request
  - **PureGRAPH®** powder additives
  - **PureGRAPH®** AQUA dispersed additives
  - PureGRAPH<sup>®</sup> master-batch additives in LDPE, HDPE, EVA etc.







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### Fully integrated and robust supply chain

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$\checkmark$	Secure supply	<ul> <li>Secure supply of high-quality raw graphite material</li> <li>Sourced from FGR's graphite mining facilities in Sri Lanka (DSO)<sup>1</sup></li> <li>99% graphite ore used, directly from the ground</li> </ul>	
$\checkmark$	Established manufacturing	<ul> <li>Operational facility at Henderson, Western Australia</li> <li>Graphene production capacity of 100tpa</li> <li>Minimal capex required to scale plant to 1,000tpa</li> </ul>	
$\checkmark$	Proprietary Manufacturing process	<ul> <li>Single-step electrochemical exfoliation process</li> <li>High-yield graphite-to-graphene conversion rates of &gt;95%, providing significant operating cost advantage</li> </ul>	
$\checkmark$	Fully accredited	<ul> <li>Full quality and product accreditations, including REACH UK &amp; EUROPE, ACIS Australia</li> <li>Pending EPA in the US</li> </ul>	
$\checkmark$	Accessible and growing end market	<ul> <li>&gt;30 existing customers – with expanding use case</li> <li>Numerous trials with blue chip global partners underway at various development and commercial stages</li> <li>&gt;500 of inbound interest for samples and trials</li> <li>Stable and competitive pricing</li> </ul>	

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1. FGR is currently buying feedstock from a Government-owned mine. Under its current mining license, FGR has the ability to develop more tonnes of graphite to support any plant expansion.

### **Proprietary manufacturing process**

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#### FGR's proprietary manufacturing process has readily scalable technology to cater for growing demand

- **1.** High-quality graphite feedstock introduced into an electrochemical cell, where it is exfoliated into graphene platelets
- 2. Screening, filtration and refinement occurs, separating graphene from electrolyte and reducing platelet particle size, creating the **PureGRAPH**<sup>®</sup> product
- 3. PureGRAPH<sup>®</sup> AQUA is extracted and packaged
- Drying and milling occurs, producing PureGRAPH<sup>®</sup> dry powder products
- 5. Final product QAQC measurements and process
- 6. PureGRAPH<sup>®</sup> products are packaged and distributed to partners and clients around the world



# Wide variety of applications

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Adding graphene to products enhances properties and performance of industrial materials and technology

- Lightweight, improved strength, optimised energy generation and storage
- Numerous benefits to high-growth and in-demand applications across a range of industries



#### **Cement and concrete**

- Cement additives
- Enhanced dry mixing mortar
- Concrete Admixtures



#### **Energy and storage**

- Supercapacitors technology
- Hydrogen electrocatalysts
- Hydrodynamic cavitation technology
- Perovskite Solar



#### **Composites and plastics**

- Thermally conductive polymer compounds
- Enhanced FRP composites
- Unique heating devices
- Graphene-enhanced masterbatches



#### **CASE and foams**

- Electrostatic dissipative coatings
- Sporting apparel and footwear
- Noise and vibration dampening foams

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### **Cement & concrete - priority target market**

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### Cement production is one of the world's largest industrial carbon polluters – responsible for 8% of global emissions

- Global consumption of concrete stands at more than 4 billion tonnes per annum<sup>1</sup>, making it the most consumed material after water on the planet
- Global manufacturers committed to cutting CO<sub>2</sub> emissions by 25% by 2030<sup>2</sup>
- Clinker, the main binding agent in Ordinary Portland Cement, is the primary producer of carbon emissions in cement production
  - For every tonne of clinker produced, 800 to 900kg of CO<sub>2</sub> is emitted
- PureGRAPH<sup>®</sup> is proven to reduce clinker levels, delivering a green cement solution for the industry
- Following successful trials, FGR secured an agreement with Breedon Group, the leading cement manufacturer in the UK (Oct 2023)
- Demand for green cement continues to grow, with the industry forecast to be worth US\$56 billion by 2027



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### **Cement market opportunity**

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### UK, USA and EU governments and industry are actively driving "green cement" demand to achieve decarbonisation objectives

- Total global cement production in 2020 was **4.4 billion tonnes**, and is forecast to grow at a rate of 5.1% per annum
  - UK, USA, and EU combined represented **302 million tonnes** of cement
  - This equates to a potential graphene demand of circa 211,000 tonnes, based on industrial scale proven dosing rates
  - 1% of this graphene demand is equivalent to ~AUD\$90m in annual graphene sales<sup>1</sup>, based on existing cost structure
- Based on current clients FGR is working with, there is opportunity to provide 5-6% of global graphene demand
- This represents circa 12,000 tonnes of PureGRAPH<sup>®</sup>
- Tier 1 production facilities produce 1 million tonnes of cement, equating to ~300 tonnes of potential graphene demand



### **PureGRAPH® 'greener' cement & concrete**

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#### In the cement production process, where do CO<sub>2</sub> emissions come from?

Clinker is the main binding and strength component used to produce Ordinary Portland Cement

For every tonne of clinker produced, 800kg to 900kg of CO<sub>2</sub> is produced

# Lower carbon cements are made possible by adding PureGRAPH<sup>®</sup> - <u>reducing the required clinker</u> <u>volume</u>

- 1. Raw material extraction calcium (commonly a limestone quarry), silica, alumina and iron
- 2. Raw meal preparation crushing, proportioning, and grinding
- Rotary kiln calcination of the pre-calcined raw meal occurs, generating CO<sub>2</sub> emissions
- 4. Clinker cooled and stored
- 5. Final grinding: clinker + gypsum + mineral addition = cement



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## **Significant agreement with Breedon**

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- Following successful trials, FGR secured an agreement with
   Breedon Group, the leading cement manufacturer in the UK
- World-leading graphene-enhanced cement trials resulted in 15% reduction in carbon emissions and 10% increase in compressive strength
- Significant milestone for FGR and validates the quality and industrial scale demand potential for PureGRAPH<sup>®</sup>
- Collective goal of enhancing Breedon's cement properties to improve compressive strength and reduce carbon footprint
- Graphene-enhanced grinding aids and cement admixtures formulated and supplied by FGR along with methods for addition into cement production facilities
- Phase three trials set to commence next quarter



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#### Phase one of world-leading trials in United Kingdom at Breedon's Hope Cement Works in Derbyshire produced positive initial results, including:

• Up to **10% increase** in early-stage compressive strength of CEM II cement

Industrial scale trials with Breedon

- Immediate 15% reduction in CO2 emissions as a result of lower clinker factor
- Graphene-enhanced concrete slab poured as part of wheel washing facility at a major highway infrastructure project in south-east England
- Strength and integrity maintained after +200 days of operation, with core samples showing absence of defects, damage or deterioration
- CEM II production increasing in line with Breedon's commitment to carbon reduction and sustainability targets



Graph 1: Increase in core strength of graphene-enhanced cement used in concrete slab.

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# Industrial scale trials with Breedon

- Phase two trials focused on optimising dosing methods, amounts, and general processing metrics
  - Four tonnes of grinding aid containing PureGRAPH<sup>®</sup> successfully produced 600 tonnes of graphene-enhanced cement at production scale
- Phase three trials will test an optimised formulation of FGR's new PureGRAPH-CEM<sup>®</sup> under full scale production conditions
  - Specialised product optimised for use in cement grinding mills, removing need for additional processing equipment
  - Over two tonnes of new aqua-dispersed product will be used to produce up to 1,000 tonnes of cement
  - Trial scheduled to begin Q1 2024/25 financial year
  - Lab-scale milling by industry trusted Kirton Concrete Services has shown PureGRAPH-CEM<sup>®</sup> can improve compressive strength
  - Research indicates FGR's new product is compatible and complementary with existing grinding aids, reducing need for alternative additives





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### **Cement and concrete success**

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Actively working with over 30 clients globally

FOSROC	BREEDON	MORGAN SINDALL	MEX	<b>SLKAB</b>
		Applications		
		Features		Benefits
Cement additi	Ves	<ul> <li>Green cement manufacturing</li> </ul>	<ul> <li>Reduction</li> </ul>	of carbon emissions
Enhanced dry	mixing mortar	<ul> <li>Shotcrete and pumping applications</li> </ul>	<ul> <li>Durability</li> </ul>	and strength
Concrete Adm	ixtures	<ul> <li>Concrete manufacturing</li> </ul>	<ul> <li>Strengthe increase control</li> </ul>	n, improve durability and orrosion resistance

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### **Energy generation and storage**

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- Conductivity and strength of **PureGRAPH**<sup>®</sup> makes it ideal as an electrode additive in batteries and supercapacitors
- Continued development and evaluation of new material opportunities for graphene-enhanced energy storage devices

Applications			Clients and opportunities	
	Features	Benefits	<ul> <li>Government-funded trial on thermally conductive solar water heating and heat exchangers for 2.000</li> </ul>	
Supercapacitors technology	<ul> <li>Metal oxide decorated products</li> </ul>	<ul> <li>Improved activated carbon</li> </ul>	<ul> <li>SENERGY</li> <li>homes in the UK, with aim of expanding to 250,000 homes</li> <li>Currently scaling up compounding production of conductive polymer and running commercial trials</li> </ul>	
Hydrogen catalysts	<ul> <li>Fuel cells</li> </ul>	<ul> <li>Cheaper production of hydrogen</li> </ul>	<ul> <li>Manufacturing perovskite solar cells at Wagga Wagga facility in New South Wales</li> <li>GRADENTCELL</li> <li>Graphene additive significantly reducing materials</li> </ul>	
Hydrodynamic cavitation technology	<ul> <li>Petroleum feedstock conversion to synthetic graphite/graphene</li> </ul>	<ul> <li>Cheaper alternatives to platinum</li> </ul>	<ul> <li>AUSTRALIA</li> <li>AUSTRALIA</li> <li>AUD\$2m CRC-P grant awarded for collaboration to commercialise perovskite technology through the development of industrial scale production processes</li> </ul>	
			<ul> <li>MOU signed to fund, design, build, and commission a small-scale hydrodynamic cavitation reactor using FGR's Kainos Technology</li> <li>Process will convert petroleum feedstock to battery-grade graphite, graphene and hydrogen</li> </ul>	

### **Composites and plastics**

- PureGRAPH<sup>®</sup> enhanced composites provide a significant improvement in material performance
- Fibre-Reinforced Polymer (FRP) composites use glass, carbon, aramid or natural fibres, in combination with polymer resins
- PureGRAPH<sup>®</sup> mixed with polymer resin prior to combination with the textile reinforcement

Applications			Clients and opportunities		
Thermally	Features	Benefits	Australia's largest swimming pool manufacturer supplying PureGRAPH®-enhanced fibreglass pool basins to international customers		
conductive polymer compounds	<ul> <li>Polymer solar thermal cells</li> </ul>	<ul><li>Increased conductivity</li><li>Greater efficiency</li></ul>	<ul> <li>Anti-static polymers for underground mining applications, as an alternative to carbon nanotubes and carbon fibres</li> </ul>		
Enhanced FRP composites	<ul> <li>Advanced fibreglass swimming pools</li> </ul>	<ul> <li>Durability and strength</li> <li>Reduced water permeability</li> </ul>	<ul> <li>Utilising PureGRAPH<sup>®</sup> in structural beams to increase fire retardancy, strength, durability, thermal and acoustic performance, with prototype launched in September as</li> </ul>		
Unique heating devices	<ul> <li>Retrofitted to gas- fired heating units</li> </ul>	<ul> <li>Greater efficiency</li> <li>Reductions in nitrous oxide and CO<sub>2</sub></li> </ul>	JDA signed for the development of PureGRAPH®- enhanced composite conveyor rollers, aiming to boost		
Graphene- enhanced masterbatches	<ul> <li>Advanced polymer materials</li> </ul>	<ul> <li>Improving electrical and thermal conductivity</li> <li>Increased strength of polymers</li> </ul>	tribotech       mechanical performance and wear life of existing material         Hubron.       FGR's UK compounding partner manufacturing optimised masterbatches tailored for food safe material		
			раскаўну		

### **CASE and foams**

- PureGRAPH<sup>®</sup> used to produce fire retardant foams & coatings, mechanically-enhanced rubbers and elastomers
- Wear linings for specialist footwear with PureGRAPH<sup>®</sup> have increased tensile strength, elongation, abrasion resistance, electrical and thermal conductivity
- PureGRAPH<sup>®</sup> benefits for coatings and ink include anticorrosion, protection from degradation, exceptional electrical conductivity, improved durability and fire retardancy
- Customers can achieve market growth through product superiority and cost savings for end users

	Applications		Clients and opportunities
	Features	Benefits	Protective mining wear liners and elastomer coatings with ophanced abrasian and corresion resistance with
Electrostatic dissipative	<ul> <li>Electrostatic dissipative flooring</li> </ul>	<ul> <li>Reducing static discharge by</li> </ul>	GROUPFGR securing a minimum phased commitment of 4,800 kgs of PureGRAPH® (Sept-21)
coatings		increasing conductivity	<ul> <li>Developing ESD coatings using PureGRAPH<sup>®</sup> which have</li> </ul>
Sporting	<ul> <li>Membranes and footwear products</li> </ul>	<ul> <li>Increasing compression and reducing abrasion to elongate lifespan</li> </ul>	achieved conductivity targets, working on scale up feasibility
footwear			<ul> <li>Developed PureGRAPH<sup>®</sup>-enhanced coating for increased tribology and wear resistance, with demonstrated</li> </ul>
Noise and	<ul> <li>Lightweight</li> <li>Reducing weight while</li> </ul>		up trials currently running
dampening foams	materials transportation	increasing performance	<ul> <li>Secured exclusive distribution deal with €160 million turnover organisation, providing deeper market penetration with access to sales expertise of 30 K&amp;M</li> </ul>

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Note: CASE stands for coatings, adhesives, sealants and elastomers.

### **Market opportunity**

#### **Energy creation and storage**

- Key value proposition: energy efficient, electrical and thermal conductivity
- Market size by 2027:
  - Solar Water Heating \$6.6 billion
  - Perovskite \$3 billion
  - Supercapacitor \$0.9 billion
- Companies working on market disruptive technology using PureGRAPH<sup>®</sup> present an addressable market size of 300 – 500 tonnes per annum by 2027
- Represents <1% of global market opportunity</li>

Industrial applications		Approx. annual graphene	
<ul> <li>Key value proposition: physical strength, electrical and thermal properties</li> </ul>		reve	nue <sup>1</sup>
<ul> <li>Wear liners and industrial parts</li> </ul>	Total	25%	50%
<ul> <li>Wheels and rollers</li> </ul>	addressable demand	Conversion	Conversion
<ul> <li>Stator elastomers</li> </ul>	100 - 200		
<ul> <li>Insulation panels</li> </ul>	tonnes of PureGRAPH®	AUD\$30m	AUD\$57m

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Note: 1. The graphene revenue estimates in the tables above are for illustration only and are not in any way a forecast of revenue by First Graphene

	Approx. annual graphene revenue <sup>1</sup>			
Total addressable demand	0.3% of Target Market	0.6% of Target Market		
Global market size of \$10.5 billion	AUD\$30m	AUD\$60m		

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# **Financial performance**

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#### **Commercial momentum**

- Continue to increase sales and consistent revenue growth
- Cement and concrete segment nearing to mature sales profile
- Early adopter's footprint increasing through organic growth
- Diversifying sales through provision of Development services



#### Decreasing cash burden each year

- Reducing non-critical spend
- Utilising non-cash incentive plans



#### Forward outlook FY24

- Forward-looking order book of circa A\$550,000
- Setting the stage for continued revenue growth and results





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Note: Refer to 2023 Annual Report for more details: https://app.sharelinktechnologies.com/announcement/asx/cdb777a41547d45c651f273cda5fc590

### **Growth pillars and pathway**

#### **FIRSTGRAPHENE**

		Pre-2020	2021	2022	2023 - beyond
(¢)	SCALABLE PRODUCTION CAPABILITY	<ul> <li>Established a world-class</li> <li>production capacity with scalable technology</li> </ul>	Unique, <b>commercial-</b> <b>scale capability</b> and repeatable quality of graphene production	<ul> <li>Readily scalable technology to address growing demand</li> <li>Optimisation trials to enhance production process and improved energy saving outcomes</li> </ul>	<ul> <li>Further optimisation to refine production processes, improve efficiencies, further reduce carbon footprint and cut output costs</li> </ul>
	GLOBAL SUPPLIER OF MATERIALS TECHNOLOGY	<ul> <li>Valuable IP portfolio, renowned application development and R&amp;D service</li> <li>PureGRAPH<sup>®</sup> incorporated into Steel Blue Safety Boots</li> </ul>	Signed collaboration agreement for HDPE enhancement Novel <b>PureGRAPH®</b> Bitumen masterbatch formulation launched	<ul> <li>Secured collaboration with global manufacturer Fosroc</li> <li>Technology partnership secured with NeoGraf</li> <li>FGR led consortium secures UK grant for low-carbon cement</li> </ul>	<ul> <li>Secured Breedon Development and Commercialisation agreement</li> <li>Commenced world-leading PureGRAPH® cement and concrete trials in the UK</li> <li>FGR &amp; partners awarded \$A2m for solar cell research</li> <li>Secured strategic partnerships for distribution and tech investment</li> </ul>
ASX:FGR	- INVESTOR PRESENTATION	<ul> <li>Successful demonstration of commercial scale PureGRAPH® rubber compounds</li> <li>Secured supply agreement with global pool manufacturer (ALT)</li> </ul>	<ul> <li>Developed <b>PureGRAPH</b><sup>®</sup></li> <li>based supercapacitor materials</li> <li>Acquired green hydrogen cavitation patents</li> </ul>	<ul> <li>JDA opens path to global heating market</li> <li>Patented next generation battery tech</li> </ul>	<ul> <li>Commercialise cutting edge green- materials technology for high- growth and in-demand industries</li> <li>Accelerate additional large scale infrastructure projects</li> <li>Transform valuable IP portfolio</li> </ul>

Note: ALT = Aquatic Leisure Technologies

### **Upcoming milestones**

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### Key takeaways

#### FIRSTGRAPHENE



World-leading advanced materials supplier focused on fast-growing graphitic technologies



Established global industry partnerships in place to leverage paths to major markets



World-class production capacity with readily scalable technology



Established international customer base, primed for substantial growth



New revenue streams through product research and development services



Targeting traditional and emerging markets, critical to decarbonising the global economy

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## Appendices

April 2024



### Manufacturing process and technology

#### FIRSTGRAPHENE

Modular and scalable production plant	Proprietary processing technology
<ul> <li>Plant based in Henderson, WA</li> <li>Current capacity of 100tpa of PureGRAPH® graphene products</li> <li>Operating at ~10 tpa as sales book is built (break-even at ~20tpa)</li> <li>Capable of scaling to 1,000tpa with minimal investment (~\$1.0-1.5m over 3 years)</li> <li>Potential to establish additional manufacturing facilities close to key markets</li> <li>600t of graphite feedstock stored near WA facility</li> <li>Continued process optimisation to reduce cost of production increasing available margin</li> <li>Recently acquired and commissioned new grinding mill from Retsch to further enhance capabilities particularly in energy storage applications</li> </ul>	<ul> <li>Utilises own proprietary process of electrochemical exfoliation for producing graphene from graphite</li> <li>Process works by applying a voltage which drives certain ions to intercalate (become inserted) into the carbon layers, expanding and pushing the layers apart</li> <li>High-yield exfoliation process enables graphite-to-graphene conversion rates above 95%, providing significant operating cost advantage over other graphene suppliers</li> <li>Continued investment in R&amp;D to enhance processing capabilities across all applications</li> <li>Cavitation chemistry – prototype process for direct conversion of petroleum to high value graphene and graphite products</li> </ul>

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### **PureGRAPH®** graphene products (cont'd)

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	NPA	AQUA	MB-LDPE	MB-EVA	MB-EVA-B
Description	For dispersion across a range of solvents, polymer resins, elastomers and water-based formulations	Easy-to-use graphene paste for formulation into water and polar solvent-based formulations	Pelletised additive designed for use in polyolefin systems including polyethylene and polypropylene	Extends applications for blending in elastomers such as rubber systems and plastics, as well as thermoplastics	Designed for blending into asphalt mixtures to improve mechanical properties and stability
Form	Powder (available in 3 sizes)	Paste	Pellet	Pellet	Pellet
Application	Fibre-reinforced plastic composites, elastomers, plastics, coatings, textile materials, energy storage and concrete	Paints, inks, latex, polymer and cement composites	Compatible with a wide range of materials and easily added into thermoplastic production processes such as, injection molding, blow molding and extrusion	Blended to thermoplastics and elastomers such as rubber systems and plastics; potentially compatible with resins, waxes, adhesives	Binder for bitumen used in asphalt systems
Benefits	Increased flexural and compressive strength, reduced water and chemical permeability, anti-corrosion, fire retardancy	Improves mechanical performance, abrasion resistance, anti-corrosion, fire retardancy and thermal and electrical conductivity	Enhances mechanical and thermal properties, tensile strength, fatigue resistance	Softness, flexibility, polarity	Easy to incorporate using standard processing techniques, supplied in pellet form as a MB for ease of dosing and handling
Sectors	Mining services, leisure equipment, textiles, automotive components and construction	Construction, automotive, leisure products, textiles, coatings	Mining services, leisure equipment, textiles, automotive, construction, coatings	Mining services, leisure equipment, textiles, automotive, construction, coatings	Construction of roads and other asphalt surfaces

### WORLD-LEADING GRAPHENE ENHANCED CEMENT TRIALS

#### FIRSTGRAPHENE

#### Validating PureGRAPH<sup>®</sup> as a viable product to reduce carbon emissions

- FGR-led consortium commenced graphene enhanced cement and concrete trials in June 2023
- Graphene enhanced cement used to create a real-world wheel washing facility at a major infrastructure project in the UK
- Initial results demonstrated:
  - **15% reduction in carbon emissions**, providing cement and concrete industry a solution to meet environmental sustainability targets
  - **10% increase in compressive strength,** meeting performance expectations and criteria
  - Confirmed viability of producing industrial-scale quantities of graphene enhanced cement
- Phase 2 trials aimed at optimising dosage rates and addition methods

