

21<sup>st</sup> March 2024

## New opportunities in green hydrogen production following positive electrocatalyst results

### Highlights

- **Graphene enhanced electrocatalysts give superior performance during the manufacture of ‘green hydrogen’ by water electrolysis**
- **PureGRAPH® combined with low-cost transition metals could produce higher-performing, affordable electrocatalysts for global markets**
- **Additional grant funding secured to further advance graphene-enhanced electrocatalyst development**
- **First Graphene enters a research partnership with Greater Manchester Electrochemical Hydrogen Cluster, targeting net-zero technologies**

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First Graphene Limited (ASX:FGR; “First Graphene” or “the Company”) is pleased to provide an update on commercialisation opportunities presented by development of graphene materials.

The Company’s recent development of new graphene enhanced electrocatalysts targets the rapidly growing production of ‘green hydrogen’ by water electrolysis.

#### **Electrocatalyst production accelerates towards commercialisation**

First Graphene has completed a 12-month project in the United Kingdom to develop low-cost, high-performing electrocatalysts for hydrogen production. Electrocatalysts are materials that reduce the energy required and subsequently speed up the rate of hydrogen and oxygen production when splitting water by electrolysis. They are essential for the economic production of ‘green hydrogen’.

Current state-of-the-art electrocatalysts use high-cost rare metals such as iridium and ruthenium, which drives up operating costs and hinders adoption of water electrolysis for the manufacture of ‘green hydrogen’.

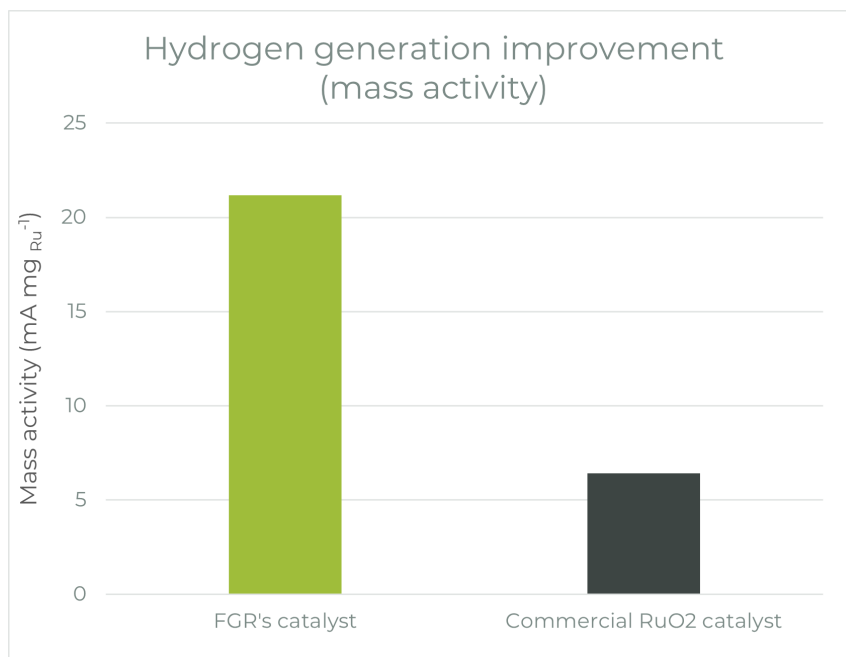
Supported by A\$183,000 in funding from Innovate UK, the project trialled production of graphene enhanced water-splitting electrocatalysts.

In this project, First Graphene investigated the optimal formulation of coatings to be applied to electrodes, which were tested against defined performance targets.

The Company benchmarked the graphene enhanced, low-cost electrocatalysts against two different commercial catalyst materials<sup>1</sup>, assessing the product’s stability and mass activity. Results indicated First Graphene’s catalyst requires less energy to produce hydrogen when compared to a commercial iridium catalyst in similar conditions.

Depicted in Graph 1 (overpage), the solution also performed remarkably well compared to a commercial ruthenium catalyst, resulting in close to three-times the output in hydrogen production despite using the same quantity of ruthenium.

Importantly, this means First Graphene's electrocatalyst has the potential to become a commercially beneficial solution that allows quantities of high-cost and scarce ruthenium to last longer during hydrogen production.



*Graph 1: Comparison of hydrogen generation using equivalent quantities of ruthenium.*

First Graphene's solution can combine low-cost transition metals with the high conductivity of the Company's world-leading PureGRAPH® platelets to produce higher-performing, affordable electrocatalysts.

The results from the Innovate UK project have been used to leverage further government funding via a new project to assess the details of scaled catalyst production.

The A\$155,000 project commenced under The Centre of Expertise in Advanced Materials and Sustainability (CEAMS) pilot scheme in the UK.

The project aims to define process parameters in pilot-scale production of graphene catalyst materials, which is a necessary step towards full-scale production and partnerships with end users.

This provides the Company with another opportunity to commercialise catalyst materials without removing resources from existing projects.

Electrolyser manufacturing capacity is expected to grow globally from 19 gigawatts per year to 155 gigawatts per year by 2030<sup>2</sup>. From this, a projected 35 gigawatts per year is expected to be in the form of Proton Exchange Membrane (PEM) electrolyzers.

First Graphene's enhanced electrocatalysts are well suited for hydrogen synthesis in a PEM electrolyser. Representatives for the Company recently attended the World Electrolyser Congress in Düsseldorf, where there was significant interest in high performing, cost-effective catalysts for PEM electrolyzers, placing First Graphene in a strong position to meet this global demand.

With an increasing focus on net zero targets around the world, the combination of more cost-effective materials, matched with First Graphene's in-house expertise on electrochemistry, can assist the Company scale production to enable low-cost, high-performing catalysts for a rapidly growing technology.

### **Dedicated electrochemical testing facility opens**

First Graphene has the capability to perform electrochemical analysis in-house, following the establishment of a dedicated testing facility at its UK headquarters in Manchester.

This new facility will result in faster, more cost-effective testing of electrocatalysts and graphene materials, paving the way to develop new products such as graphene oxide, and create new application opportunities and insights for existing PureGRAPH® materials.

### **New partnership to drive carbon neutrality in UK**

First Graphene has embarked on a new project with the Greater Manchester Electrochemical Hydrogen Cluster (GMEHC) in the United Kingdom.

The GMEHC is a consortium of leading research facilities and experts aiming to address material challenges and measurement problems holding back innovation in hydrogen, fuel cell technology and electrolyser value chains.

The aim of this project will be to analyse graphene metal oxides through the GMEHC to demonstrate the technology in an electrolyser stack for the first time.

This project targets the displacement of iridium in electrolysers, with testing to provide key performance data including stability and efficiency metrics.

Data from this stack testing will be provided to catalyst end-users, which will mark an important milestone towards the commercialisation of this licenced technology.

The Company expects existing plant equipment to be utilised for production, which will further diversify First Graphene's product lines to meet demand from new industries.

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

*"First Graphene has developed a significant variety of opportunities to provide low-cost, high-performing solutions for the global renewable energy sector.*

*"I am proud of the work conducted by the First Graphene team, and I look forward to seeing these opportunities progress towards commercialisation."*

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<sup>1</sup> References for commercial catalysts:

- DOI: 10.1038/s41467-023-41102-2 Lee et al., Nat. Comms, 2023, 14, 5402
- DOI: 10.1039/d0ee01960g Zhao et al., Energy Environ. Sci., 2020, 13, 5143—5151

<sup>2</sup> [Global Hydrogen Review 2023](#)

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

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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.*