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Independent testing showcases graphene's potential as a high-performing catalyst for hydrogen production

Highlights

- Independent research found graphene-enhanced electrocatalysts reduce amount of power required during hydrogen generation
- Addition of PureGRAPH[®] to electrodes resulted in 43% reduction in overpotential, the energy (excess voltage) required to drive the hydrogen generation reaction
- Improvements to process also increased throughput by 64% and reduced raw material costs by up to 50%

First Graphene Limited (ASX: FGR; "First Graphene" or "the Company") is pleased to announce details of an independent study into the performance of graphene-based electrocatalysts for the generation of green hydrogen.

The study by the Centre for Process Innovation UK ("CPI") showed electrodes composed of First Graphene's metal-oxide doped graphene reduced the amount of power required to produce hydrogen from the electrolysis of water.

Analysis by the CPI has confirmed metal-oxide doped graphene materials from First Graphene can reduce overpotential, which is a measurement of energy efficiency of the electrolyser, by 43%.

Improvements to the process were also identified that can increase throughput by 64%, reduce raw material costs by 50% and broaden metal oxide options in the product, providing a cost-effective commercial solution for the green hydrogen industry.

Electrocatalysts can reduce the power consumption for water electrolysis, but state-of-the-art electrocatalysts use rare and expensive metals, limiting their widespread use.

The electrocatalysts used in this trial by the CPI are an advancement of First Graphene's previously developed metal-oxide supercapacitor materials.

The study tested electrodes containing metal-oxide graphene materials in a hydrogen generation cell for overpotential and stability by linear sweep voltammetry and constant current measurements, respectively.

The PureGRAPH[®]-based electrodes showed overpotential values (at 10mA/cm²) of 0.175V for graphene-manganese-oxide and 0.170V for graphene-ruthenium-manganese-oxide, compared with 0.305V for commercial ruthenium oxide¹ under similar conditions.

The CPI benchmarked the performance versus literature values for metal oxide and confirmed the graphene-based electrodes provide equivalent performance at lower metal oxide concentrations.

Patent applications have been filed by the Company, strengthening the core patent portfolio which

is exclusively licensed to the company from the University of Manchester.

This project was funded by the Net-Zero Tees Valley program, which will also allow First Graphene to continue to develop manufacturing know-how for production of the electrode materials.

The electrolysis of water using renewable electricity has been acknowledged as a route to generation and production of green hydrogen.

The International Energy Agency forecasts that energy production by hydrogen electrolysis will increase from 11 GW in 2022 to between 170 and 365 GW by 2030².

In addition, the global market for water electrolyzers is forecast to exceed USD \$7 billion by 2031³ and the market for electrocatalyst materials is expected to reach USD \$1.2 billion by 2030⁴.

First Graphene Managing Director and CEO Michael Bell said:

“This is an exciting development for First Graphene as we develop our next generation of products that can be used in high value industries that will be part of the solution for decarbonisation.

With rapid growth expected in hydrogen production catalysts, these results place First Graphene in a strong position to provide a high-performing, cost-effective, graphene-enhanced solution.”

References

¹ Hou, S. et al. (2022) *Langmuir*, 38, 12118–12123. Available at: <https://doi.org/10.1021/acs.langmuir.2c00962>

² International Energy Authority (2023), Electrolysers. Available at: <https://www.iea.org/energy-system/low-emission-fuels/electrolysers#tracking>

³ BIS Research (2022) Water Electrolysis Market - A Global and Regional Analysis. Available at: <https://bisresearch.com/industry-report/water-electrolysis-market.html>

⁴ Skyquest Marketing (2023) Global Hydrogen Production Catalysts Market Insights. Available at: [https://www.skyquestt.com/report/hydrogen-production-catalysts-market#:~:text=What%20is%20the%20global%20market,period%20\(2023%2D2030\)](https://www.skyquestt.com/report/hydrogen-production-catalysts-market#:~:text=What%20is%20the%20global%20market,period%20(2023%2D2030))

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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 conducts world-leading, innovative Research and Development through their United Kingdom entity, First Graphene (UK) Ltd.