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Gelion plc
("Gelion", "Company" or the "Group")

Gelion Produces Solid-State Separator suitable for Li-S and Li-NMC batteries via Oxford University's Breakthrough Technology

Gelion (AIM: GELN), the Anglo-Australian battery innovator, announces it has successfully fabricated advanced sulfide-based solid-state separators utilising the novel Intellectual Property (IP) licensed from Oxford University Innovation Limited (Oxford University). This result enables Gelion to proceed to the next stage of optimisation for this separator which has the potential to not just increase the cycle life of existing lithium metal batteries but also for Gelion's high energy density GEN 3 lithium-sulfur (LiS) cells.

Solid Electrolyte Separators (SES) are recognised as a key enabler to long duration high energy lithium metal batteries due to their potential to increase safety, cycle life and energy density of battery technologies in which they are employed. Their implementation has been hampered due to challenges in their processability and manufacture and this successful fabrication is an important step to solving these challenges.

Significantly, these advancements:

- introduces another potential revenue stream by way of licensing to Lithium nickel manganese cobalt oxides (Li-NMC) battery manufacturers, when optimised to enable scaled production of the SES;
- facilitate the incorporation of SES into liquid-based Li-metal (e.g., Li-NMC and Lithium-air (Li-air) battery technologies), Li-S and solid-state Li-ion/Li-S cell assembly;
- relax the operational requirements (i.e. external pressure and temperature) of solid-state batteries that comprise this SES technology making this technology more viable for commercialisation.

OXLiD Ltd (OXLiD), a subsidiary of Gelion plc, has successfully fabricated a lightweight, ultra-thin, scalable and highly flexible SES, validating Oxford University's IP and paving the way for high energy and long cycle life batteries for Aerospace and Automotive applications. The work was undertaken as part of its grant funded activities whilst part of the wave 7 cohort of the Technology Developer Accelerator Programme (TDAP), via the Advanced Propulsion Centre UK (APC), funded by the Department for Business and Trade. OXLiD is further developing the novel sulfide-based SES and its pathway to commercial manufacture which we anticipate will translate to simplified cell level manufacture and subsequent cost reduction.

This development directly ties into the Group's mission to provide global energy storage solutions that are robust, safe and affordable with low environmental impact, enabling the supply of clean power for all. Testing of the GEN3 Li-S battery with this OXLiD developed SES will begin soon.

Key achievements in developing the SES include:

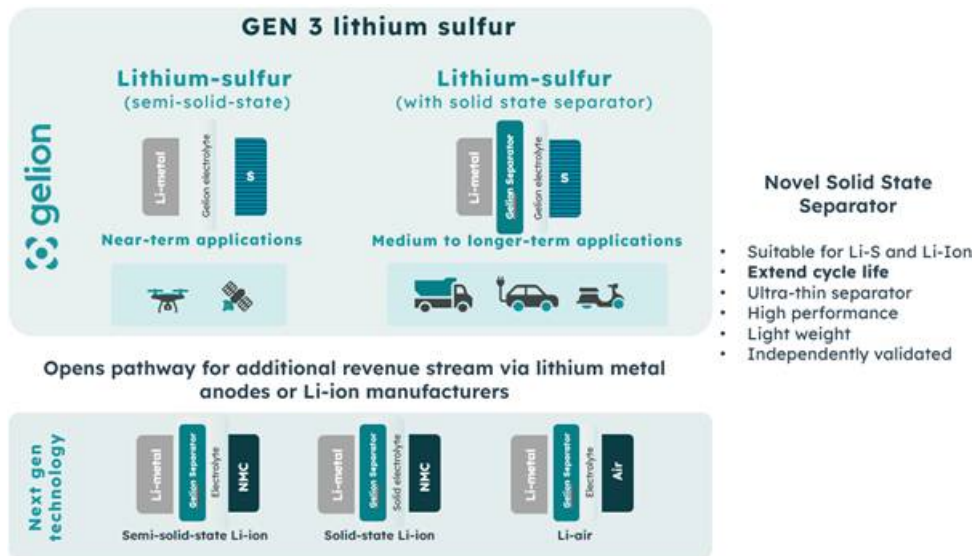
- **Potential route to increase the cycle life** of liquid electrolyte-based high energy lithium metal batteries, including Gelion's proprietary GEN 3 Li-S technology;
- **Potential to solve a key challenge** in manufacturing of solid-state lithium batteries, which require processable and thin SES;
- **Ultra-Thin Separator Development:** Successfully produced and trialled ultra-thin SES (<70 microns) with potential to reduce this significantly to enable high-performance and lightweight batteries. Thinner separators allow for more active material (anode and cathode) to be packed into the same volume, which reduces the weight of the battery;
- **Third-Party Validation:** Technology was independently validated and Gelion plans to optimise and scale the technology for commercial use.

The global separator market is projected to grow from around UDS 6 billion in 2023 to c. USD 20 billion by 2032^[1]. This growth is driven primarily by the rising adoption of electric vehicles and demand for efficient energy storage systems, which require advanced separators for performance and safety, especially in thermal stability and resistance to degradation.

John Wood, Gelion CEO commented: "This achievement marks an important milestone in unlocking the full potential of sulfur-based batteries, contributing to the global electrification revolution. When Gelion completed the acquisition of OXLiD we were keen to ensure that arrangements had been finalised around the licence between OXLiD and Oxford University Innovation for this technology, as it has potential to make a significant contribution toward performance enhancement for cells using Lithium Metal anodes. Now that the fabrication has been successfully demonstrated and the separator validated in trials, we will proceed to the next stage of optimising the separator performance. While we haven't recognised all the partners that contributed in this release due to confidentiality, everyone involved has our gratitude for

the quality of their work and effort.

"Our research and development teams at Gelion are best in class. We have some of the best minds in the industry within our business, working towards the development and commercialisation of technologies that will make a material impact on the greening of the global economy. This development, following our IP licencing agreement with Oxford University, underscores the strength of our relationships and calibre of our core partners, a key facet of our commercialisation strategy."



CONTACTS

Gelion plc

John Wood, CEO

Amit Gupta, CFO

Thomas Maschmeyer, Founder and Principal Technology Advisor

via Alma

+44 207 220 0500

Cavendish Capital Markets Limited (Nominated Adviser and Broker)

Corporate Finance

Neil McDonald

Seamus Fricker

Adam Rae

Sales

Louise Talbot

Alma Strategic Communications (Financial PR Adviser)

Justine James

Hannah Campbell

Will Ellis Hancock

+44 20 3405 0205

gelion@almastrategic.com

About Gelion

Gelion ("gel: ion") is a global energy storage innovator, supporting the transition to a more sustainable economy by commercialising two globally important next generation technologies: Lithium-Sulfur (LiS) and Zinc-based (Zn) hybrid cells to electrify mobile and stationary applications. Gelion plc (the Group) is listed on the London Stock Exchange's Alternative Investment Market and wholly owns Australia based Gelion Technologies Pty Ltd and UK based OXLiD Ltd. Gelion is designing and delivering innovative battery technologies and integrated systems solutions to enable that transition and return value for its customers and investors.

Lithium Sulfur

Gelion's effort is directed at the potential for the Li-S chemistry to deliver double the gravimetric energy density of standard Lithium-ion chemistries whilst concurrently reducing cost and increasing safety, targeting the EV and e-aviation market, helping to make global transport, energy consumption and storage more sustainable.

Gelion is developing a GEN 3 Lithium Sulfur cell product for its high energy density sulfur cathode at its expanded R&D facilities in Australia and UK, enabling it to integrate with a variety of anodes ranging from graphite to silicon to lithium metal, depending on the targeted application.

Gelion's GEN 3 cell is unlocking the potential of sulfur batteries for a wide range of global mobile applications including electrical vertical-take-off-and-landing (eVTOL), drone markets, electric vehicles (EVs) and stationary energy storage (ESS).

Advantages of Gelion's GEN 3 Lithium Sulfur

- **High energy density** - Energy density > 400 Wh/kg, when using a 10+ Ah pouch cell.
- **Semi-solid-state as a route to increased longevity/cycle life:** GEN 3 employs a semi-solid-state mechanism, maintaining the sulfur-based cathode materials in the cathode, preventing their diffusion into the electrolyte and diminishing associated

battery degradation caused by reactive polysulfides. This approach mitigates the major degradation factor associated with conventional Li-S technology.

- **Increased sulfur utilisation:** GEN 3 demonstrates the full theoretical capacity of sulfur, i.e. a much higher sulfur utilisation than found in conventional Li-S approaches.
- **Simplified supply chain:** The innovative cathode is produced by mixing commercially available materials with abundant sulfur using a low-energy, room-temperature process, with potential to eliminate the need for pre-fabrication of the sulfur composite (sulfur composite is related to cathode active material in conventional lithium-ion batteries), streamlining the associated supply chain and production process and enabling localised manufacturing.
- **Environmental and economic benefits:** The water-based, standard-atmosphere cathode production process eliminates the need for toxic solvents, leading to significant cost savings and enhanced manufacturability.

Glossary

IMPa	This level of pressure replicates real-world pressure conditions inside batteries and is crucial for ensuring the durability, efficiency, and performance of the separator in practical applications.
Ah	Ampere hours. A measure of capacity stored in the cell. The larger the number the higher the capacity.
Energy density (Wh/kg)	The ratio of energy stored per unit weight i.e. Watt-hours per kilogram. The higher the number the lighter the battery.
Pouch cell	An industry standard format of a battery which comprises a flat pouch-shaped design with a multi-layered laminate structure.
Solid-to-solid conversion	A low or polysulfide-free conversion of sulfur within the cathode. Polysulfides are a dissolved form of sulfur that is corrosive and reduces cycle life in traditional lithium-sulfur batteries. Solid-to-solid conversion helps mitigate the formation of these polysulfides.
Semi-solid state as a route to increased longevity/cycle life:	Gelion's GEN 3 technology can employ a semi-solid-state mechanism, maintaining the sulfur-based cathode materials in the cathode, preventing their diffusion into the electrolyte and diminishing associated battery degradation caused by reactive polysulfides. This approach mitigates the major degradation factor associated with conventional Li-S technology.
Solid state separator	A solid-state separator is a solid material that separates the anode and cathode in a battery, enabling ion transfer while preventing short circuits enhancing battery safety, supports higher energy densities, and allows stable use of a lithium metal anode, increasing capacity and lifespan.
Cycle life	The number of full charge and discharge cycles a battery can complete before its capacity falls below a specified level, typically 80% of the original capacity. Higher cycle life indicates longer-lasting performance.

Zinc

Gelion is adapting its zinc technology to comprise an alternate cathode technology, a zinc hybrid cell to develop complementary next-generation batteries for the lead-acid eco-system. Early testing indicates that this solution has the potential to maintain good energy density levels with enhanced cost and safety aspects. Once fully developed, Gelion intends for our zinc technology to provide a durable and sustainable market extension within the ecosystem that supports lead-acid batteries.

Recycling

Gelion is pioneering an innovative battery recycling technology designed to enhance and supplement current recycling methods. Our technology aims to significantly reduce the initial costs of recycling plants, minimize waste, and lower carbon emissions, while improving the purity of metal products and enabling efficient lithium extraction. This advancement will allow for a broader range of scrap materials to be recycled. Currently in the feasibility stage, Gelion is committed to advancing our technology to a pilot-scale demonstration, paving the way for commercialisation through material production and IP licensing.

Integration

Gelion leverages its significant integration and BMS capability to deliver bespoke BESS for Australian customers. These BESS are currently based on lithium-ion technology and will also include Gelion's next-generation batteries as these become available. Gelion will deploy BESS with our proprietary cloud-based battery monitoring system, which will provide real-time diagnostics and alerts to maximise performance and return on investment for our customers.

About the Advanced Propulsion Centre UK

The Advanced Propulsion Centre UK (APC) collaborates with UK government, the automotive industry and academia to accelerate the industrialisation of technologies that support the transition to zero-emission vehicles and towards a net-zero automotive supply chain in the UK.

Established in 2013, the APC, with the backing of the UK Government's Department for Business and Trade (DBT), has facilitated funding for 304 low-carbon and zero-emission projects involving 538 partners. Working with companies of all sizes, this funding is estimated to have helped create or safeguard over 59,000 jobs in the UK. The technologies and products that result from these projects are projected to save over 425 million tonnes of CO₂.

With deep sector expertise and cutting-edge knowledge of new propulsion technologies, the APC's role in building and advising project consortia helps projects start more quickly and deliver increased value, accelerating new technologies to market. The APC works to drive innovation and encourage collaboration, building the foundations for a successful and sustainable UK automotive industry.

sustainable UK automotive industry.

In 2020 the UK Government established the Automotive Transformation Fund (ATF) to accelerate the development of a net-zero vehicle supply chain, enabling UK-based manufacturers to serve global markets. ATF investments are accessed through the APC and awarded by DBT to support strategically important UK capital and R&D investments that will enable companies involved in batteries, motors and drives, power electronics, fuel cells, and associated supply chains to anchor their future.

For more information go to apcuk.co.uk or follow us @theapcuk on X and Advanced Propulsion Centre UK on LinkedIn.

For media enquiries contact:

Laurah Hutchinson-Strain
Senior PR Manager
Email: Laurah.hutchinson-strain@apcuk.co.uk

About Oxford University Innovation

Oxford University Innovation (OUI) is the research commercialisation office of the University of Oxford, recognised worldwide for its ability to engage academic prowess through licensing, catalyse innovative solutions through consulting services, and support the creation of spinouts, start-ups, and social ventures. OUI is dedicated to showcasing these transformative technologies on the global stage, bridging the realms of academia and the commercial world, thereby weaving a future where knowledge, innovation and partnership drive forward solutions to global challenges.

[1] <https://introspectivemarketresearch.com/reports/battery-separator-market/>

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