

## **FIREBIRD SECURES KEY LMFP PATENTS – STRENGTHENS GLOBAL IP POSITION IN NEXT-GEN BATTERY MATERIALS**

### **HIGHLIGHTS**

- Two core “Invention Patents” granted via fast-track channel for proprietary LMFP (Lithium Manganese Iron Phosphate) preparation methods; four additional patents progressing through review, with international filings underway.
- Patents 100% owned by Firebird, these patents underpin our 2023 LMFP strategy and position the Company as a leader in Western LMFP development.

### **GAME-CHANGING INTEGRATION**

- Firebird’s R&D process enable direct integration of High Purity Manganese Sulphate (HPMSM) production with pre-cathode active material (pCAM) synthesis, which are expected to deliver a structural cost advantage, setting Firebird apart in the global LMFP market.
- Firebird is emerging as an industry leader in HPMSM and MFP (Manganese Iron Phosphate) pCAM production, with clear advantages in process efficiency and cost competitiveness.

### **LMFP BATCH TEST WORK UPDATE**

- Stage 1 LMFP test work nearing completion, with over 100 batches of industry standard LMFP successfully produced at Firebird’s vertically integrated, world-class “Ore to Cathode” R&D Centre.
- Battery grade MFP precursor materials are being prepared for evaluation by potential customers in China and abroad.

### **POSITIONED FOR A US\$20B+ MARKET**

- Increasing global interest in manganese-rich battery chemistries reflected by two new LMFP factories (60,000 t/a) commissioned in H1 2025. Inbound manganese chemicals enquiries cover multiple battery chemical applications.
- LMFP is emerging as a next-gen alternative to LFP, with Soochow Securities forecasting it could replace 50% of LFP by 2030—creating a >US\$20B market. Firebird’s integrated model is well positioned to capitalise on this growth.

### **GLOBAL VISION, LOCAL EXECUTION**

- Recent export restrictions by China on advanced LMFP technology highlight the strategic value of Firebird’s fully owned IP. Developed independently, our technology can be deployed both within China and in Western markets.
- Internal feasibility studies initiated, including options for partial relocation of test-work outside China to support international engagement.

**Firebird Managing Director Mr Peter Allen commented:** *“We committed early to this technology because we recognised the critical role manganese would play in next-generation battery chemistries. It’s incredibly rewarding to see LMFP now gaining the global traction we had forecast internally—and for Firebird to be increasingly recognised as an industry leader in HPMSM technology and processing.*”

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*"The granting of our first two patents in China marks a significant milestone in securing the value of Firebird's LMFP innovation pipeline. These inventions are designed to improve energy density, rate performance, and thermal stability—key attributes driving the shift toward cost-effective, manganese-rich cathode materials."*

*"Our process innovation in manganese sulphate production is expected to deliver a meaningful cost advantage by eliminating the energy-intensive crystallisation step, historically the largest contributor to operating costs. This integrated approach enhances both efficiency and product quality. We expect our IP portfolio to continue expanding as we progress toward commercial-scale production."*

**Australian-owned Firebird Metals Limited (ASX: FRB, Firebird or the Company)** is pleased to announce significant progress in the protection of its proprietary intellectual property (IP) for advanced lithium manganese iron phosphate (LMFP) cathode materials, a core pillar of the Company's vertically integrated battery materials strategy.

Two patents have now been granted in China, with a further four patents accepted into the national application process and currently progressing through the review stage. Together, these patents represent a comprehensive portfolio of innovations in LMFP material design and synthesis, from precursor engineering to final cathode structures.

The patents are the result of Firebird's active R&D program, following the execution of a binding strategic collaboration agreement with Central South University (CSU) of Hunan in October 2024. CSU is one of the world's foremost institutions in lithium-ion battery technology. CSU's alumni include leaders from BYD and Ronbay Technology, further strengthening the commercial relevance of this technical partnership.

By integrating high purity manganese sulphate (HPMSM) production directly with the MFP pre-cathode active material (pCAM) process, Firebird expects to achieve a significant structural cost advantage in LMFP manufacturing.

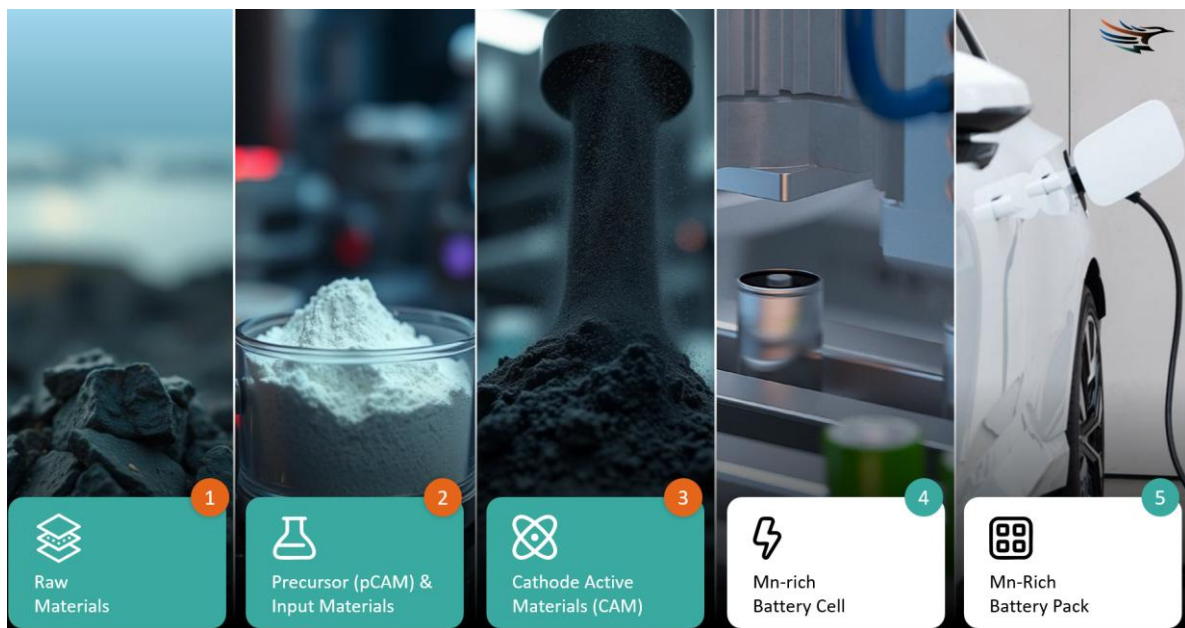


Image 1: Simplified steps in LMFP (Manganese Rich) process, with steps 1 to 3 being Firebird's area of focus

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This vertically integrated approach is a key differentiator as the Company continues to advance its strategy to become a low-cost, globally competitive producer of manganese-based battery materials. Importantly all intellectual property remains owned by Firebird Metals.

Stage 1 test work is now completed with over 100 batches now completed. Batch production remains ongoing, with the objective of building a sample stockpile of MFP for distribution to both Chinese and Western cathode manufacturers.



*Images 2 and 3: Lab cell test work and CAM production equipment (Spray Dryer)*

Next steps in the Company's LMFP development include:

- Stage 2 test work will incorporate customer feedback to tailor LMFP products for specific customer requirements.
- Pilot-scale MFP plant under planning, targeting >200 tonnes per annum capacity.
- Evaluating integration of MFP/LMFP production into commercial plant design.
- Internal feasibility studies initiated, including options for partial relocation of test-work outside China to support international engagement.

The use of manganese-rich cathodes is expanding rapidly, with LMFP (Lithium Manganese Iron Phosphate) emerging as the leading candidate for mass-market adoption. MFP precursor materials will be critical in facilitating the broader shift from LFP to LMFP cathodes, supporting the next generation of cost-effective and higher-performing battery technologies. Soochow Securities forecast that LMFP will replace 50% of LFP to become a >US\$20 billion market by 2030.

The Company's long-term objective is to provide fully integrated processing solutions for manganese-rich cathode materials, with an initial focus on the rapidly emerging LMFP technology. Our R&D centre is initially based in China, where global leadership in cathode material development and production makes it the ideal foundation. Our long-term objective is to replicate these activities in Western markets through the deployment of advanced technology and the establishment of localised production facilities. The Company looks forward to providing further updates as the test work program progresses.

Recent export restrictions imposed by China on advanced LMFP technology underscore the strategic importance of Firebird's fully owned intellectual property. Developed independently through in-house innovation and collaboration with leading research institutions allows the Company to retain full control over its development pathway and commercialisation strategy. With the flexibility to operate

both within China—where Firebird’s R&D and pilot operations are based—and in Western markets, Firebird is uniquely positioned to supply high-performance, manganese-rich cathode materials to a rapidly growing global battery industry.



Images 4 and 5: Manganese sulphate process and crystalliser reactor

## SUMMARY OF PATENTS APPLIED FOR BY FIREBIRD

### Patent 1: Modified Lithium Manganese Iron Phosphate Material and Its Preparation Method, Cathode, and Lithium-ion Battery

(Application No: CN2025105932960) - GRANTED

This invention provides a modified lithium manganese iron phosphate (LMFP) material, its preparation method, cathode, and lithium-ion battery. The modified LMFP material includes an iron-based triphenylphosphine borohydride compound coated on the surface of LMFP. The compound has the formula  $\text{FeCl}_{2-x}(\text{BH}_4)_x(\text{PPh}_3)_2$ , where  $0 < x < 2$ . The iron-based compound modification significantly enhances the electrochemical stability and performance of the cathode material, thereby improving the battery’s cycle life and overall electrochemical characteristics.

### Patent 2: A Modified Lithium Manganese Iron Phosphate Cathode Material, Its Preparation Method and Application

(Application No: CN2025104717007) - Patent in Processing

This invention discloses a modified LMFP cathode material, its preparation method, and application. The cathode material is a mixture composed of a LMFP-carbon composite and a modifier of the formula  $\text{MFeAsO}_x\text{F}_{1-x}$ , where M is La, Nd, Ce, or Pr, and  $0.8 \leq x \leq 0.9$ . The carbon improves conductivity of the LMFP, while the modifier further enhances electron and ion transport. The synergy between carbon and the modifier results in improved energy efficiency, better reversible capacity, and higher capacity retention.

### **Patent 3: Lithium Manganese Iron Phosphate Material, Its Preparation Method and Application**

#### **(Application No: CN2025104776151) - Patent in Processing**

This invention relates to the field of lithium-ion battery materials and discloses a method for preparing LMFP, which includes:

1. Heating a mixture of lithium salt solution, ammonia, and biomass to produce Material A, then stirring until bubbling occurs;
  2. Adjusting the pH of A to 6–7, adding manganese and iron salt solutions to obtain Material B;
  3. Adding phosphate solution to B to get Material C;
  4. Heating C to evaporate the solvent and obtain Material D;
  5. High-temperature sintering of D in an inert atmosphere to produce LMFP particles.
- The resulting LMFP precursor has a hollow structure that is retained after high-temperature lithiation, resulting in faster ion transport, excellent rate performance, larger surface area, and improved chemical stability.

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### **Patent 4: Modified Lithium Manganese Iron Phosphate Material, Its Preparation Method and Application**

#### **(Application No: CN2025104733457) - Patent in Processing**

This invention provides a modified LMFP material with a surface coating layer over the LMFP matrix. The coating is composed of  $\text{Li}_2\text{Mn}_x\text{Fe}_y\text{SiO}_4$  and  $\text{LiMn}_x\text{Fe}_y\text{BO}_3$  (where  $x + y = 1$ ). The dual coating enhances the structural and electrochemical stability of the LMFP, improves ion transport, and boosts the discharge capacity and cycling performance of the cathode material.

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### **Patent 5: Bismuth Silicate Coated Lithium Manganese Iron Phosphate Material, Its Preparation Method, and Lithium-ion Battery**

#### **(Application No: CN2025102052704) - Patent in Processing**

This invention belongs to the technical field of lithium-ion battery materials and discloses a bismuth silicate-coated LMFP material, its preparation method, and its application in batteries. The material comprises LMFP coated partially or entirely with a bismuth silicate layer. Preparation includes:

- Ball milling LMFP, lithium source, carbon source, and water to obtain a slurry;
- Spray drying at low temperature;
- Wet mixing with silicon and bismuth sources;
- Spray pyrolysis and sintering to obtain the final coated LMFP.

This coating enhances high-temperature cycling stability while maintaining high discharge capacity in lithium-ion batteries.

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**Patent 6: Modified Lithium Manganese Iron Phosphate Cathode Material, Its Preparation Method and Application**

**(Application No: CN2025106602864) - GRANTED**

This invention provides a modified LMFP cathode material that consists of a LMFP core and an outer layer. The outer layer comprises, from the core outward: a first  $\text{Li}_3\text{InO}_3$  layer, an LMFP layer, and a second  $\text{Li}_3\text{InO}_3$  layer. This configuration enhances both interfacial and bulk electron/ion transport, resulting in significantly improved rate capability and cycling performance of the LMFP cathode.

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**This announcement has been approved for release by the Board.**

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## About Firebird Metals Limited

Firebird Metals is an advanced manganese developer focused on combining mining and downstream processing with a dedication to the advancement of the EV battery sector.

The Company is currently progressing its unique China-focused lithium manganese iron phosphate (LMFP) battery strategy, which will develop Firebird into a near-term producer of high-purity, battery-grade manganese sulphate, a key cathode material in LMFP batteries for electric vehicles.

Execution of this strategy will place Firebird at the forefront of manganese sulphate production, at a time when the use and demand for manganese in batteries continues to rapidly grow. Due to the low number of ASX-manganese developers and increasing use of LMFP by car manufacturers, Firebird is in a strong position to benefit from this growing market and deliver significant value to its shareholder base.

The Company also has a project portfolio located in the renowned East Pilbara manganese province of Western Australia, which boasts a total Resource of 234Mt<sup>1,2</sup>, with exciting exploration and development growth upside. The portfolio is led by the flagship Oakover Project, which holds a Mineral Resource Estimate of 176.7 Mt at 9.9% Mn, with 105.8 Mt at 10.1% Mn in an Indicated category.

The Company's other key project is Hill 616 which provides Firebird with a compelling growth opportunity. Hill 616 contains an Inferred Mineral Resource of 57.5Mt at 12.2% Mn and shares similar geological traits to Oakover.

The Company is committed to generating sustainable long-term value and growth for stakeholders, through the implementation of best practice exploration methods while prioritising the well-being, health and environmental protection of its employees and communities it operates in.

## JORC Compliance Statement

This announcement contains references to Mineral Resource Estimates, which have been reported in compliance with Listing Rule 5.8 and extracted from previous ASX announcements as referenced.

The Company confirms that it is not aware of any new information or data that materially affects the information previously reported and that all material assumptions and technical parameters underpinning the Mineral Resource Estimates continue to apply and have not materially changed.

<sup>1</sup> See ASX announcement dated 23 March 2023: Indicated Resource of 105.8Mt at 10.1%; Inferred Resource of 70.9Mt at 9.6% for global Resource of 176.7 Mt at 9.9% Mn.

<sup>2</sup> See ASX announcement dated 1 December 2021: Inferred Resource of 57.5 Mt at 12.2% Mn.