LMFP for Li-ion Batteries

Patent Landscape Analysis - January 2026

Who are the key players and newcomers in the global IP race for LMFP batteries?

REPORT OUTLINE

ORDER ONLINE

- LMFP for Li-ion Batteries
  Lithium Manganese Iron Phosphate, from precursors and cathode active materials, to cathode and battery cells
- Patent Landscape Analysis
- January 2026
- PDF >400 slides
- Excel file >7,800 patent families
- Reference: KM26002
- 4,990 EUR for a multi-user license
- Optional Power BI interactive dashboard (please contact us)

KEY FEATURES

- **Global patenting trends**, including time evolution of patent publications, countries of patent filings, etc.
- **Main patent assignees** and **IP newcomers** grouped by geographical area.
- Key players' **IP position** and the relative **strength** of their patent portfolio.
- Focus on key players' IP portfolios.
- Patents categorized by **supply chain segments** (precursors, cathode active materials, cathode, battery cells).
- For each segment: **IP dynamics**, ranking of **main patent assignees**, IP **newcomers**, **key IP players**, **key patents**, and **recent developments**.
- **Excel database** containing all patents analyzed in the report, including **patent segmentations** and hyperlinks to an **updated online database**.

RELATED REPORTS

- Li-ion Battery Cathode Active Material Recycling
- Silicon Anode for Li-ion Batteries
- Halide Solid Electrolytes for Li-ion Batteries

RELATED MONITORS

- Silicon Anode Li-ion Batteries
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LMFP: A promising cathode material for next-generation Li-ion batteries witnessing a fast-growing and shifting patenting activity

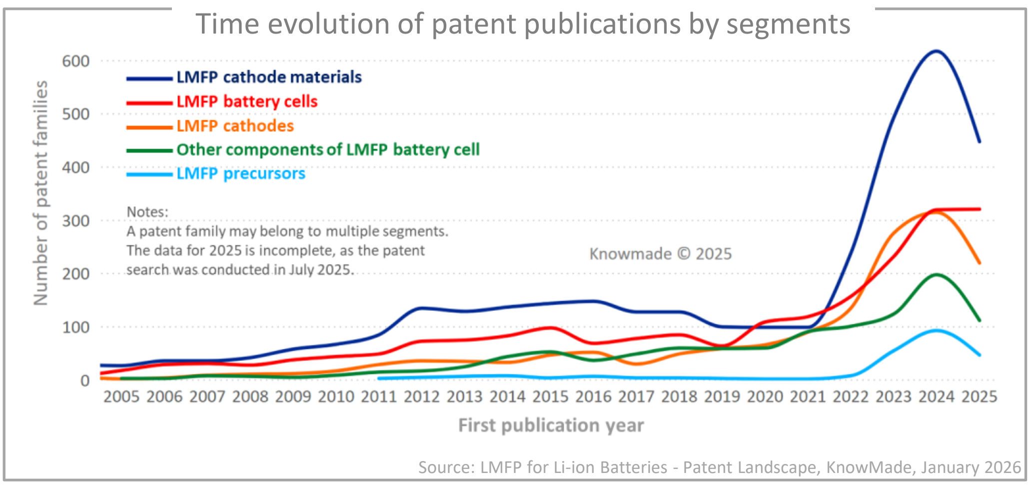
The burgeoning global demand for highly efficient and environmentally friendly energy storage solutions, driven primarily by the widespread adoption of electric vehicles (EVs) and large-scale energy storage systems (ESS), has made the development of advanced lithium-ion battery (LIB) cathode materials a critical focus. While the olivine-structured lithium iron phosphate (LFP) is widely valued for its high safety, stability, low cost, and environmental friendliness, its relatively low operating voltage, typically around 3.4 V (vs. Li/Li+), limits its energy density and falls short of the increasing requirements for high-performance applications. Lithium manganese iron phosphate (LMFP), developed by partially substituting iron with manganese in the olivine structure, has emerged as a promising alternative. This composition incorporates the high thermal stability and cost-effectiveness of LFP while leveraging the higher redox potential of manganese, resulting in a 10% to 20% higher energy density than LFP. Despite these advantages, LMFP faces intrinsic challenges notably poor electronic and ionic conductivity, sluggish lithium-ion diffusion kinetics, manganese dissolution issues, and capacity degradation related to the Jahn–Teller effect induced by Mn^{3+}. Consequently, extensive research, supported by robust patent activity, has been performed for the last ten years.

In this context, the present report aims to provide a **comprehensive analysis of the patent landscape** related to the **lithium manganese iron phosphate, from materials to battery cells**. Knowmade's analysts have selected and analyzed more than 7,800+ patent families (inventions) related to LMFP.

The general objectives of the present report are:

- to identify and map the key IP players in each chosen technological segment (precursors, cathode active materials, cathodes, battery cells).
- to assess the geographical distribution of patent families, current legal status of patents, helping stakeholders understand strategic positioning and navigate their competitive environment.
- to get an overview of key and recent patents across the value chain.

These strategic insights will support R&D, investment, and policy decisions in the evolving field of Li-ion battery.



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Understanding the main trends, the key players' IP position and IP strategy

IP competition analysis should reflect the vision of players with a strategy to enter and develop their business in the LMFP Li-ion battery market. In this report, Knowmade's analysts provide a comprehensive overview of the competitive IP landscape and latest technological developments in this field. The report identifies the IP leaders, most active patent applicants, and new entrants in the IP landscape. It also sheds light on under-the-radar companies and new players in this field. The report covers IP dynamics and key trends in terms of patents applications, patent assignees, filing countries, and technological segment of interest (precursors, cathode active materials, cathode, battery cells, etc.). Dedicated sections of the report focus on the patent portfolios of key players from various countries.

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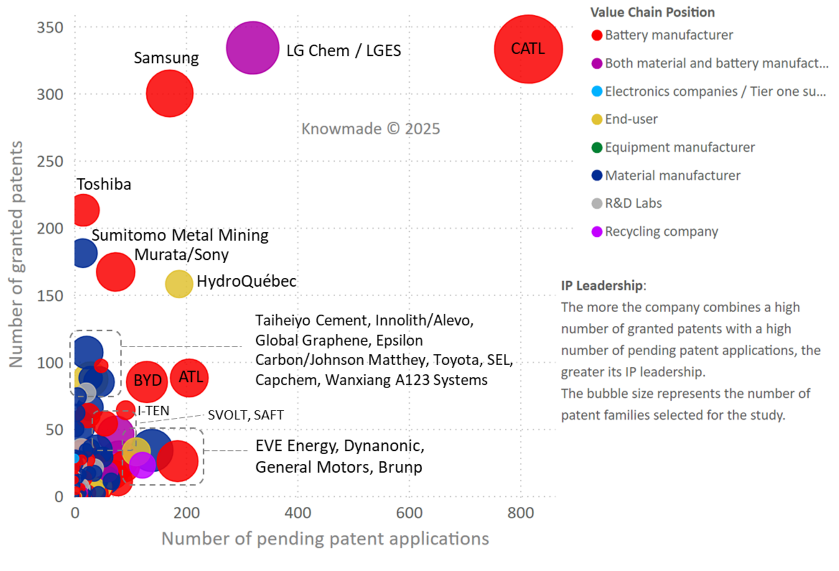
IP leadership of patent assignees



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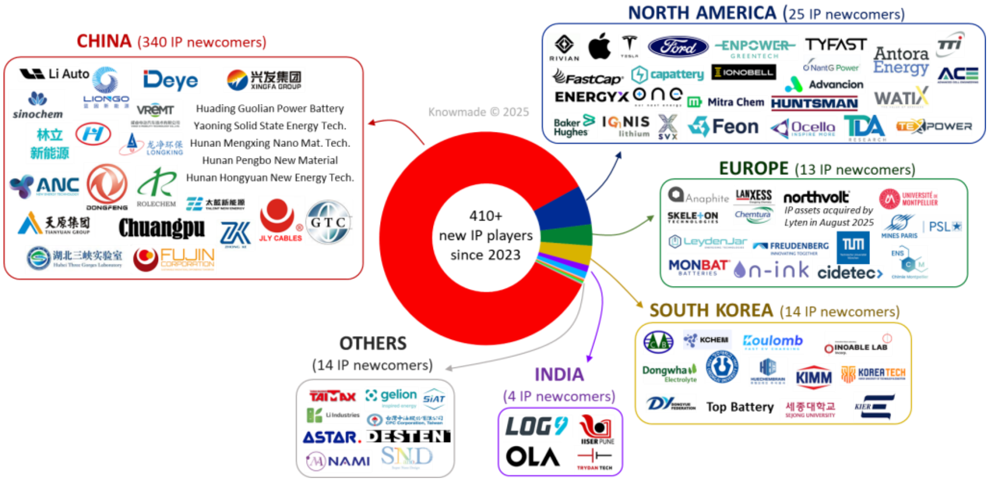
IP newcomers (first LMFP-related patent published in 2023 or later)



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Identify the IP newcomers

Since 2023, Chinese entities have established themselves as dominant newcomers in the LMFP patent landscape. Over 410 new IP players have entered the LMFP patent landscape since 2023, with around 80% coming from China. More than 20 newcomers are non-Chinese start-ups. The main Chinese entrants are material and battery manufacturers, while other Asian newcomers are primarily R&D institutes and material producers. American newcomers include both start-ups and established companies, whereas other non-Asian entrants consist mainly of R&D organizations, battery manufacturers, and material suppliers. Dedicated sections of the report focus on the **patent portfolios of IP new entrants** from various countries.

Deep dive into key and recent patents across LMFP value chain

All patents selected for this study have been categorized by supply chain segment (precursor, cathode material, cathode, battery cells).

For each supply chain segment, this report includes a time-evolution of patent applications, main and key patent assignees, and a description of key and recently patented technologies. An understanding of the current technical challenges addressed in the patents is also presented.

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Precursor-related key patents

Patent number & assignee	Legal status	Material Type / Key Features	Advantage Provided
KNOWLITECH (EP4[illegible])	Pending (CN, EP, WO, KR)	Mn1−xFexPO4 or Mn1−a−bFeaMbPO4 precursors with a **nanoporous structure and an extremely small particle size** (at most 50 nm), **often doped with one or more elements (M) such as Co, Mg, B, V, Ti)**	Improves the specific capacity, rate performance, and cycle performance of the resulting battery cathode material. The preparation method simplifies the process by not requiring a reducing agent or soluble ferrous salt.
YANG ZHIKUAN (CN1[illegible])	Lapsed (CN)	Battery-grade MnxFe1−xPO4 precursor synthesized via **hydrothermal oxidation-coprecipitation**, where both Mn and Fe are in the trivalent state (Mn3+, Fe3+)	The method is simple and practicable, easy for large-scale production, and the prepared precursor exhibits high purity and uniform distribution of iron and manganese elements at the atomic level, making it an optimal LiFeMnPO4 precursor
LB GROUP (CN11[illegible])	Pending (CN)	**Spherical-like Manganese-Titanium Co-doped Iron Phosphate precursor**	Solves the problem of low purity and uneven doping. Achieves high purity, uniform element doping distribution, high tap density, low specific surface area, and easy compaction, leading to good electrochemical performance and improved compacted density/energy density of the cathode material
PULEAD TECH. IND. (CN10[illegible])	Granted (CN)	FexMn1−x−yMyPO4·zH2O intermediate. **Preparation uses an ethanol-water mixed system.**	Provides a preparation method that is simple in process, low in cost (solvent can be recycled), high in yield, and low in reaction temperature. It ensures uniform mixing of Fe and Mn at the atomic level.
SUMITOMO METAL MINING (WO2[illegible])	Granted (JP)	**Manganese Iron Ammonium Phosphate precursor** (NH4MnxFe1−xPO4·H2O).	Allows for the production of a positive electrode active material with fine particle diameters (crystallite diameter≤50 nm) and a carbon content of 1%–5%, resulting in high initial discharge capacity (≥150 mAh/g) and high energy efficiency (≥85% efficiency).
CHEMISCHE FABRIK BUDENHEIM (US9[illegible])	Granted (IN, MY)	Mn-bearing monometal or mixed-metal phosphate precursors (Mnx,Mety)3(PO4)2·3H2O) **with an orthorhombic cell, often featuring a platelet-shaped morphology (thickness 20 nm to 70 nm).**	The process is comparatively energy-efficient and simple and yields high purity material suitable for producing cathode materials with high energy storage density levels. The platelet morphology is particularly advantageous for the final lithiated cathode material.
PINNACLE MAT. TECH./ JAYSON NEW ENERGY MAT. (EP46[illegible])	Granted (CN) Pending (WO)	Phosphate precursor (**LixMy(PO4)(x+y)/2Az·wH2O**) containing lithium, transition metals (including Fe and Mn), and crystal water.	The precursor has good uniformity and excellent structural stability. It enables the preparation of olivine cathode material through low-temperature sintering (260°C–600°C). The final material exhibits good electrochemical properties.
ROUTE JJ (US20[illegible])	Lapsed (CN, EP, KR, JP, US)	Composite cathode material precursor and active material featuring **Hollow Nanofibrous Carbon integrated with an olivine-type lithium phosphate cathode material (LidMPO4).**	Improves electric conductivity and ensures high capacity density suitable for high-capacity batteries because the active material is loaded both outside and inside the hollow nanofibrous carbon, preventing wasted space. The resulting battery shows improved electric conductivity, energy density, stability, safety, and cycle life characteristics.

Source: LMFP for Li-ion Batteries - Patent Landscape, KnowMade, January 2026

Useful Excel patent database

Patent database

This report also includes an extensive **Excel database with** all patents analyzed in this study, including **patent information** (numbers, dates, assignees, title, abstract, etc.), **hyperlinks to an updated online database** (original documents, legal status, etc.), and **supply chain segments** (precursors, cathode active materials, cathodes, battery cells).

Companies mentioned in the report (non-exhaustive)

INDUSTRIALS: CATL, LG Chem/LG Energy Solutions, Samsung, Dynanonic, BYD, EVE Energy, Murata/Sony, ATL, Guoxuan High Tech Power Energy/Gotion, SVOLT, Toyota, Taiheiyo Cement, Toshiba, Sumitomo Chemical/Tanaka Chemical, Tinci Materials Technology, Envision/AESC, Global Graphene, COSMX/COSLIGHT, Sumitomo Metal Mining, Sunwoda, General Motors, Rongbay Technology, HydroQuébec, Reliance New Energy/Lithium Werks, Epsilon Carbon/Johnson Matthey and more.

R&D LABORATORIES: SEL, Kyushu University, AIST, Tokyo Metropolotan University, Central South University, Institute of Physics, Tsinghua University, Beijing Institute of Technology, Hanyang University, UNIST, KAIST, RIST, KERI, CEA, CNRS, Fraunhofer, Université de Montréal, University of Chicago, University of Michigan, Lockheed Martin/UT-Battelle and more.

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