

REPORT OUTLINE

➤ Status of the battery patents

- April 2018
- PDF with >170 slides
- Focus on 2017 IP activity
- Excel file detailing >40,900 patent families
- €6,490 for a multi-user license

➤ 2018 battery patent watch service

- Get updated data during one year
- Excel file quarterly updated
- €5,990 for annual subscription



KEY FEATURES OF THE REPORT

❖ Categorization of patents

- By **supply chain segment** (electrolyte, separator, electrode, cell, pack/system)

- By **battery technology**

(Li-ion, Ni-MH, Redox Flow, Li-Air, Li-S, Na-ion and Mg-ion).

❖ 1997-2017 worldwide IP dynamics by supply chain segment and battery technology

❖ Overview of the 2017 worldwide patenting activity for each supply chain segment and each battery technology

- New **patent applications**
- New **granted** patents
- **Expired** or **revoked** patents

❖ Ranking of main patent applicants by supply chain segment and battery technology

- For 1997-2017 period
- For patents published in 2017
- For patents granted in 2017
- For patent expired in 2017

❖ Noticeable patents newly published, granted or expired in 2017

- For **battery cells morphology** (microbatteries, flexible batteries, solid-state batteries)

- For **battery technologies**

(Li-ion, Ni-MH, Redox Flow, Li-Air, Li-S, Na-ion, Mg-ion)

- For **electrode materials of Li-ion battery**

(lithium, silicon, LTO, graphene, NMC, LCO, LFP, NCA, LMO)

❖ Main development trends by battery technology

❖ Noteworthy 2017 news on patent litigation

❖ Excel database with key patents analyzed in this study, including technology segmentation.

RELATED REPORTS

- [NMC Li-ion batteries](#) (Knowmade, 2017)
- [Microbatteries](#) (Knowmade, 2016)
- [Status of Rechargeable Li-ion Battery Industry](#) (Yole Développement, 2017)
- [Li-ion Battery Packs for Automotive and Stationary Storage Applications](#) (Yole Développement, 2018)

STATUS OF THE BATTERY PATENTS

Status of Patenting Activity – April 2018

Battery domain combines major market stakes with an increasing and diversifying number of innovations and involved companies.

What are the main patents, technologies and competitive trends in 2017?

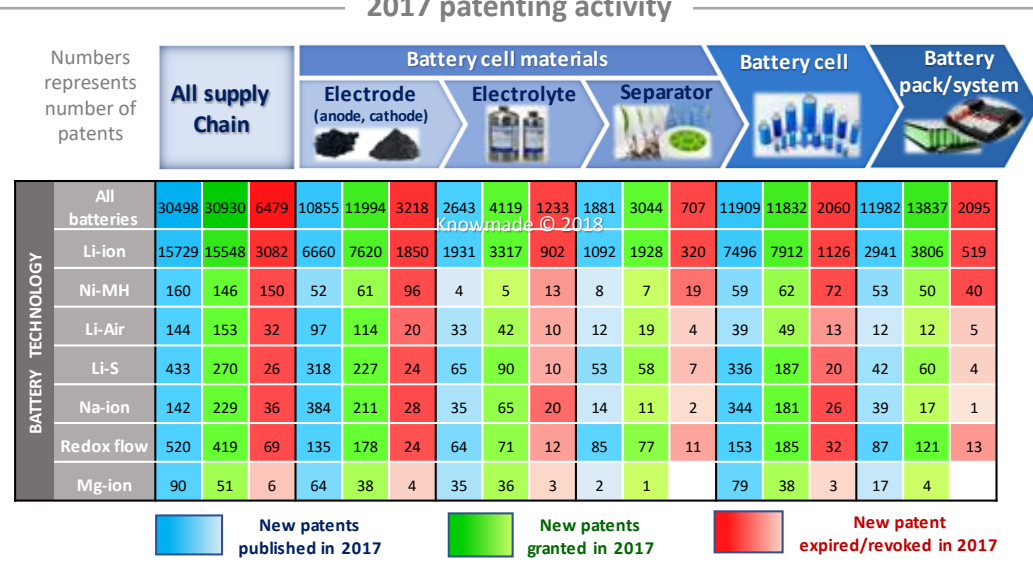
BATTERY IP ACTIVITY IS BOOMING ALONG WITH THE MARKET

Worldwide demand for energy storage devices is booming since 2000's, leading to a very dynamic battery market. The number of battery applications is diversifying and growing (portable consumer devices, electronic devices, electric vehicles, smart grids, etc.), and each of them requires specific performances (capacity, energy density, power density, self-discharge, stability, operating temperatures), morphologies/weight, safety, and cost constraints. Thus, battery has attracted significant research attention at all supply chain level (electrode, electrolyte, separator, cell, pack and system) over the last 10 years, resulting in intensive patenting activity, with a substantial increase during the past years. More than 300,000 patent families⁽¹⁾ related to batteries have been published worldwide since the early 1990s. In 2017, more than 30,400 new patent families were published, 30,900+ patents were granted, and 6,400+ patents expired. In such fast-growing and dynamic battery market, it is essential to track patents in order to anticipate changes, quickly detect business opportunities, and identify emerging research areas and cutting-edge technology developments.

In this report, we reveal the main 2017 trends for battery-related intellectual property (IP). We show an overview of the recent patenting activity (new patent applications, granted patents, expired patents), the main patent applicants, the major patent litigations, and the hot technological topics of the year, for each supply chain segment (electrolyte, separator, electrode, cell, pack/system) and each battery technology (Li-ion, Ni-MH, redox flow, Li-Air, Li-S, Na-ion and Mg-ion batteries). The report includes a special focus on the most interesting patents of the year.

(1) A patent family is a set of patents filed in multiple countries by a common inventor(s) to protect a single invention.

2017 patenting activity



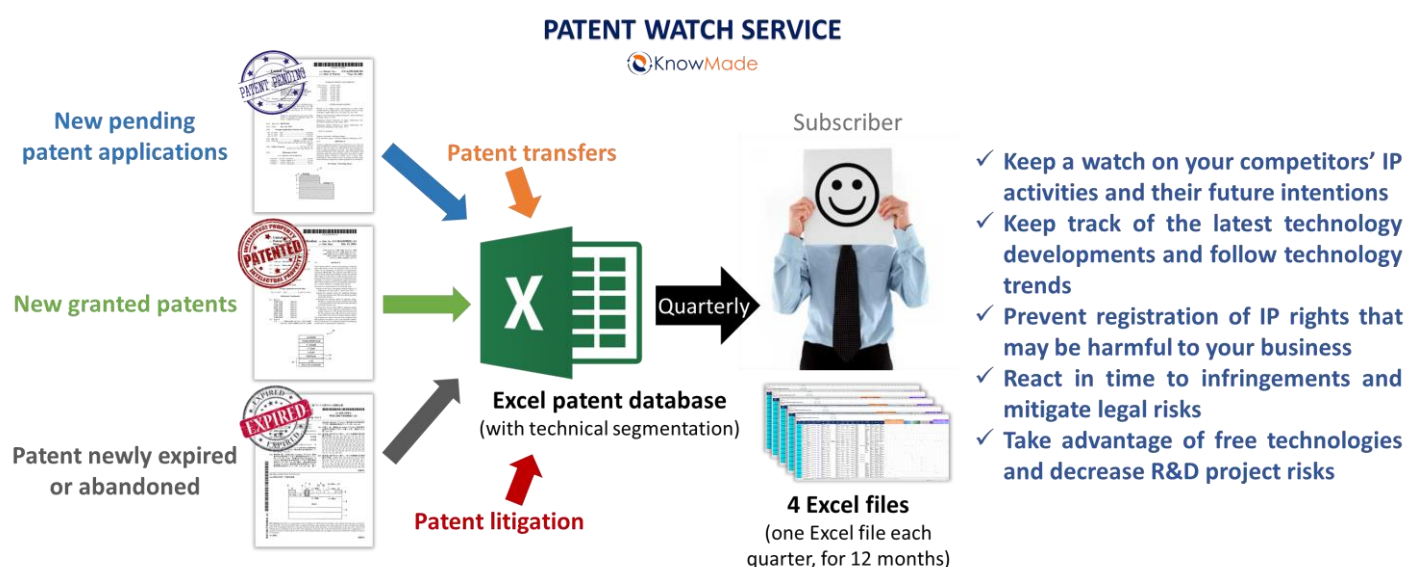
This report details the two ways envisioned by R&D players to meet market performances expectations: improve existing battery technologies and develop new battery technologies. Nowadays, lead-acid batteries and Li-ion Batteries are leading battery market. Li-ion battery is a mature technology but its performances can still be improved and its costs reduced, leading to a thriving IP activity. Other technologies are commercialized for automotive and consumer applications (Ni-MH battery), stationary applications (Redox flow, aqueous Na-ion and Na-S batteries) and medical devices (Zn-air batteries). Within last years, new battery technologies have been developed (organic Na-ion, Li-S, Li-Air, Mg-ion and Al-ion batteries) and could be commercialized within next 20 years. Patenting activity on all these technologies is detailed in the report.

USEFUL PATENT DATABASE (>40,900 patent families)

The report also includes an **Excel database** containing >40,900 patent families of the **main patent assignees** and related to the **key battery technologies**. This useful patent database allows **multi-criteria searches**, including patent numbers, priority/publication dates, patent assignees, titles, abstracts, claims, legal status of patents, hyperlinks to original documents, and **technical segmentation** (electrode, electrolyte, separator, battery cell, battery pack/system, Li-ion, Ni-MH, Redox flow, Lead, Li-Air, Li-S, Na-ion, Mg-ion, solid-state).

2018 BATTERY PATENT WATCH SERVICE: GET UPDATED DATA ON BATTERY PATENT ACTIVITY

With the **booming number of companies** involved in battery IP and the **proliferation of battery technologies**, take advantage of **quarterly updated Excel file** including the patents newly **published, granted or expired** during the past **3 months**, plus the latest **patent transfers** and noteworthy news on **patent litigation**. The patents will be **categorized** by supply chain segments (**electrode, electrolyte, separator, battery cell, battery pack/system**) and battery technologies (**Li-ion, Ni-MH, Redox flow, Lead, Li-Air, Li-S, Na-ion, Mg-ion, solid-state, thin film/flexible, lithium metal electrode, NMC cathode for Lithium battery, Silicon anode for Lithium battery**). This useful patent database allows for **multi-criteria searches** (patent numbers, priority dates, patent assignees, titles, abstracts, claims, legal status of patents, hyperlinks to original documents), and also includes several **charts highlighting the main IP trends of the past 3 months** for each technical segment (patent applicants, etc.).



Keep a watch on your competitors' IP activities and their future intentions.

With the help of the patent watch service, you will be aware of your competitors' current patenting activities, their IP dynamics, patent transfers including acquisitions and licenses, patent litigation, technology development and R&D strategies. You will also be able to rapidly detect new entrants in your business area.

Keep track of the latest technology developments and follow technology trends.

By keeping note of any recent patent filings, you can track the newest innovations in the battery field. You will get details on claimed inventions and you can follow technology developments. New technical solutions could inspire and improve your R&D activity.

Prevent registration of IP rights that may be harmful to your business.

You will obtain information on patent applications filed even before exclusive rights have been granted and you can react in time to prevent registration of IP rights that may be harmful to your business.

React in time to infringements and mitigate legal risks.

Monitoring both newly-issued patents and patent litigation allows you to regularly assess your freedom-to-operate, ensuring your products or processes are not covered by granted patents and thus they can be manufactured, sold or used safely without infringing valid IP rights owned by others.

Take advantage of free technologies and decrease R&D project risks.

By tracking both expired patents and abandoned patents, you will be able to identify inventions entering the public domain that you can use safely for your development.

COMPANIES MENTIONED IN THE REPORT (NON-EXHAUSTIVE)

3M, A123 Systems, AGC, Amperex, Automotive Energy Supply, Bak, BASF, BMW, Boston Power, BYD, Chery Automobile, FAW Automobile, Denki Kogyo/Denka, Denso, Donguan Kaixin Battery Material, DuPont, Easpring Material Technology, Ecopro, Envia, General Motors, GS Yuasa, Hitachi, Honda, Huawei, Jinhe New Materials, Johnson Controls Technology, JX Nippon Mining Metals, Kokam, L&F, Leneng Battery, Leyden Energy, LG Chem, Li-Tec Battery, Mitsubishi, Mitsui Mining & Smelting, Murata Manufacturing, Nano One Materials, Nec, Nippon Chemical Industrial, Nissan, Panasonic, Posco, Renault, Reshine New Material, Robert Bosch, SAFT, Samsung SDI, Sanyo Electric, Seeo, SEL, SK Innovation, Solvay, Sony, Sumitomo, Tanaka Chemical, Techelios, Toda Kogyo, Toray Industries, Toshiba, Toyota, University of Chicago, Umicore, etc.

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ABOUT KNOWMADE

Specializing in patent analysis and scientific information, **Knowmade** provides technology intelligence and IP strategy consulting services. The company supports R&D organizations, industrial companies, and investors in their business development by offering them a deep understanding of their IP environment and technology trends.

Knowmade operates in the following industrial sectors: Compound Semiconductors, Power Electronics, RF & Microwave Technologies, LED/OLED Lighting & Display, Photonics, Memory, MEMS & Sensors, Manufacturing & Advanced Packaging, Batteries & Energy Management, Biotechnology, Pharmaceuticals, Medical Devices, Medical Imaging, and Agri-Food & Environment. **Knowmade's** experts provide prior art search, patent landscape analysis, scientific literature analysis, patent valuation, IP due diligence, and freedom-to-operate analysis. In parallel, the company proposes litigation/licensing support, technology scouting, and IP/technology watch services. **Knowmade's** analysts combine their technical and patent expertise with powerful analytics tools and proprietary methodologies to deliver relevant patent analyses and scientific reviews.

ORDER FORM

STATUS OF THE BATTERY PATENTS

Status of Patenting Activity – April 2018

Ref.:KM18004

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City:

State:

Postcode/Zip:

Country:

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FRANCE

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Bank: Banque Populaire Méditerranée, CAP 3000 Quartier du lac, 06700 St Laurent du Var

IBAN: FR76 1460 7003 6360 6214 5695 139

BIC/SWIFT: CCBPFRPPMAR

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RETURN ORDER BY

E-mail: contact@knowmade.fr

Mail: KnowMade S.A.R.L. 2405 route des Dolines, BP 65 06902 Sophia Antipolis FRANCE

PRODUCT ORDER

Patent Analysis Report "Status of Battery Patents"

☐ €6,490 – Corporate license

☐ €5,990 – Single user license*

Patent Watch Service "2018 Battery Patent Watch"

☐ €5,990 - Excel file quarterly updated (1 year)

For price in dollars, please use the day's exchange rate.
For French customer, add 20% for VAT.

All reports are delivered electronically in PDF format and Excel format at payment reception.

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I hereby accept Knowmade's Terms and Conditions of Sale
Signature:

TERMS AND CONDITIONS OF SALES

Definitions

“Acceptance”: Action by which the Buyer accepts the terms and conditions of sale in their entirety. It is done by signing the purchase order which mentions “I hereby accept Knowmade’s Terms and Conditions of Sale”.

“Buyer”: Any business user (i.e. any person acting in the course of its business activities, for its business needs) entering into the following general conditions to the exclusion of consumers acting in their personal interests.

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“Intellectual Property Rights” (“IPR”) means any rights held by the Seller in its Products, including any patents, trademarks, registered models, designs, copyrights, inventions, commercial secrets and know-how, technical information, company or trading names and any other intellectual property rights or similar in any part of the world, notwithstanding the fact that they have been registered or not and including any pending registration of one of the above mentioned rights.

“License”: For the reports and databases, 2 different licenses are proposed. The buyer has to choose one license:

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“Seller”: Based in Sophia Antipolis (France headquarters), Knowmade is a technology intelligence company specialized in the research and analysis of scientific and technical information. We provide patent landscapes and scientific state of the art with high added value to businesses and research laboratories. Our intelligence digests play a key role to define your innovation and development strategy.

1. Scope

1.1 The Contracting Parties undertake to observe the following general conditions when agreed by the Buyer and the Seller. ANY ADDITIONAL, DIFFERENT, OR CONFLICTING TERMS AND CONDITIONS IN ANY OTHER DOCUMENTS ISSUED BY THE BUYER AT ANY TIME ARE HEREBY OBJECTED TO BY THE SELLER, SHALL BE WHOLLY INAPPLICABLE TO ANY SALE MADE HEREUNDER AND SHALL NOT BE BINDING IN ANY WAY ON THE SELLER.

1.2 This agreement becomes valid and enforceable between the Contracting Parties after clear and non-equivocal consent by any duly authorized person representing the Buyer. For these purposes, the Buyer accepts these conditions of sales when signing the purchase order which mentions “I hereby accept Knowmade’s Terms and Conditions of Sale”. This results in acceptance by the Buyer.

1.3 Orders are deemed to be accepted only upon written acceptance and confirmation by the Seller, within [7 days] from the date of order, to be sent either by email or to the Buyer’s address. In the absence of any confirmation in writing, orders shall be deemed to have been accepted.

2. Mailing of the Products

2.1 Products are sent by email to the Buyer:

- within [1] month from the order for Products already released; or

- within a reasonable time for Products ordered prior to their effective release. In this case, the Seller shall use its best endeavours to inform the Buyer of an indicative release date and the evolution of the work in progress.

2.2 Some weeks prior to the release date the Seller can propose a pre-release discount to the Buyer.

The Seller shall by no means be responsible for any delay in respect of article 2.2 above, and including in cases where a new event or access to new contradictory information would require for the analyst extra time to compute or compare the data in order to enable the Seller to deliver a high quality Products.

2.3 The mailing of the Product will occur only upon payment by the Buyer, in accordance with the conditions contained in article 3.

2.4 The mailing is operated through electronic means either by email via the sales department. If the Product’s electronic delivery format is defective, the Seller undertakes to replace it at no charge to the Buyer provided that it is informed of the defective formatting within 90 days from the date of the original download or receipt of the Product.

2.5 The person receiving the Products on behalf of the Buyer shall immediately verify the quality of the Products and their conformity to the order. Any claim for apparent defects or for non-conformity shall be sent in writing to the Seller within 8 days of receipt of the Products. For this purpose, the Buyer agrees to produce sufficient evidence of such defects.

2.6 No return of Products shall be accepted without prior information to the Seller, even in case of delayed delivery. Any Product returned to the Seller without providing prior information to the Seller as required under article 2.5 shall remain at the Buyer’s risk.

3. Price, invoicing and payment

3.1 Prices are given in the orders corresponding to each Product sold on a unit basis or corresponding to annual subscriptions. They are expressed to be inclusive of all taxes. The prices may be reevaluated from time to time. The effective price is deemed to be the one applicable at the time of the order.

3.2 Payments due by the Buyer shall be sent by cheque payable to Knowmade, PayPal or by electronic transfer to the following account:

Banque Populaire Méditerranée, CAP 3000 Quartier du lac, 06700 St Laurent du Var

BIC or SWIFT code: CCBPFRPPMAR

IBAN: : FR76 1460 7003 6360 6214 5695 139

To ensure the payments, the Seller reserves the right to request down payments from the Buyer. In this case, the need of down payments will be mentioned on the order.

3.3 Payment is due by the Buyer to the Seller within 30 days from invoice date, except in the case of a particular written agreement. If the Buyer fails to pay within this time and fails to contact the Seller, the latter shall be entitled to invoice interest in arrears based on the annual rate Refi of the «BCE» + 7 points, in accordance with article L. 441-6 of the French Commercial Code. Our publications (report, database, tool...) are delivered only after reception of the payment.

3.4 In the event of termination of the contract, or of misconduct, during the contract, the Seller will have the right to invoice at the stage in progress, and to take legal action for damages.

4. Liabilities

4.1 The Buyer or any other individual or legal person acting on its behalf, being a business user buying the Products for its business activities, shall be solely responsible for choosing the Products and for the use and interpretations he makes of the documents it purchases, of the results he obtains, and of the advice and acts it deduces thereof.

4.2 The Seller shall only be liable for (i) direct and (ii) foreseeable pecuniary loss, caused by the Products or arising from a material breach of this agreement

4.3 In no event shall the Seller be liable for:

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b) any claim attributable to errors, omissions or other inaccuracies in the Product or interpretations thereof.

4.4 All the information contained in the Products has been obtained from sources believed to be reliable. The Seller does not warrant the accuracy, completeness adequacy or reliability of such information, which cannot be guaranteed to be free from errors.

4.5 All the Products that the Seller sells may, upon prior notice to the Buyer from time to time be modified by or substituted with similar Products meeting the needs of the Buyer. This modification shall not lead to the liability of the Seller, provided that the Seller ensures the substituted Product is similar to the Product initially ordered.

4.6 In the case where, after inspection, it is acknowledged that the Products contain defects, the Seller undertakes to replace the defective products as far as the supplies allow and without indemnities or compensation of any kind for labor costs, delays, loss caused or any other reason. The replacement is guaranteed for a maximum of two months starting from the delivery date. Any replacement is excluded for any event as set out in article 5 below.

4.7 The deadlines that the Seller is asked to state for the mailing of the Products are given for information only and are not guaranteed. If such deadlines are not met, it shall not lead to any damages or cancellation of the orders, except for non-acceptable delays exceeding [4] months from the stated deadline, without information from the Seller. In such case only, the Buyer shall be entitled to ask for a reimbursement of its first down payment to the exclusion of any further damages.

4.8 The Seller does not make any warranties, express or implied, including, without limitation, those of saleability and fitness for a particular purpose, with respect to the Products. Although the Seller shall take reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes containing contaminating or destructive properties before making the Products available, the Seller cannot guarantee that any Product will be free from infection.

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The Seller shall not be liable for any delay in performance directly or indirectly caused by or resulting from acts of nature, fire, flood, accident, riot, war, government intervention, embargoes, strikes, labor difficulties, equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not the fault of the Seller.

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6.1 All the IPR attached to the Products are and remain the property of the Seller and are protected under French and international copyright law and conventions.

6.2 The Buyer agreed not to disclose, copy, reproduce, redistribute, resell or publish the Product, or any part of it to any other party other than employees of its company. The Buyer shall have the right to use the Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use the Product for purposes such as:

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- use in any timesharing, service bureau, bulletin board or similar arrangement or public display;
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7. Termination

7.1 If the Buyer cancels the order in whole or in part or postpones the date of mailing, the Buyer shall indemnify the Seller for the entire costs that have been incurred as at the date of notification by the Buyer of such delay or cancellation. This may also apply for any other direct or indirect consequential loss that may be borne by the Seller, following this decision.

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All the provisions of these Terms and Conditions are for the benefit of the Seller itself, but also for its licensors, employees and agents. Each of them is entitled to assert and enforce those provisions against the Buyer.

Any notices under these Terms and Conditions shall be given in writing. They shall be effective upon receipt by the other Party.

The Seller may, from time to time, update these Terms and Conditions and the Buyer, is deemed to have accepted the latest version of these terms and conditions, provided they have been communicated to him in due time.

9. Governing law and jurisdiction

9.1 Any dispute arising out or linked to these Terms and Conditions or to any contract (orders) entered into in application of these Terms and Conditions shall be settled by the French Commercial Courts of Grasse, which shall have exclusive jurisdiction upon such issues.

9.2 French law shall govern the relation between the Buyer and the Seller, in accordance with these Terms and Conditions.