

The Global Advanced Li-ion and Beyond Lithium Batteries Market 2025-2035

<https://marketpublishers.com/r/G3F36F22B55FEN.html>

Date: April 2025

Pages: 735

Price: US\$ 1,600.00 (Single User License)

ID: G3F36F22B55FEN

Abstracts

The battery technology landscape is undergoing a profound transformation as the industry shifts from conventional lithium-ion solutions toward advanced chemistries and beyond-lithium alternatives. While lithium-ion (Li-ion) technology currently dominates the global battery market with over 99% market share, emerging technologies are poised to capture approximately >25% of the market by 2035. This report provides an in-depth analysis of both advanced Li-ion batteries and beyond-lithium technologies that will revolutionize energy storage across multiple applications from 2025 to 2035. Report contents include:

Battery demand in GWh by technology type (2025-2035)

Market valuation in billions of dollars

Application-specific adoption curves

Regional market development

Material consumption trends for advanced anodes and cathodes

Analysis of Next-Generation Lithium-Ion Technologies:

Silicon and silicon-carbon composite anodes

High and ultra-high nickel cathode materials

Single crystal cathodes

Lithium-manganese-rich (LMR-NMC) formulations

Advanced electrolyte systems

Lithium manganese iron phosphate (LMFP)

Beyond-Lithium Solutions:

Semi-solid-state and solid-state batteries

Sodium-ion and sodium-sulfur systems

Lithium-sulfur batteries

Lithium-metal and anode-less designs

Zinc-based technologies

Redox flow batteries

Aluminum-ion batteries

Specialized Form Factors:

Flexible batteries

Transparent energy storage

Degradable batteries

Printed and 3D-printed solutions

Application Market analysis:

Electric Vehicle Ecosystem:

Passenger electric vehicles (BEV/PHEV)

Electric buses, trucks, and commercial vehicles

Micro-mobility solutions

Off-road applications including construction and marine

Battery sizing requirements by vehicle type

Grid Energy Storage:

Large-scale installations

Behind-the-meter commercial systems

Residential storage solutions

Consumer Electronics:

Next-generation devices

Wearable technology

Portable power applications

Supply Chain and Manufacturing Analysis

Advanced cathode production methods

Silicon anode manufacturing processes

Solid-state battery production techniques

Recycling technologies for lithium-ion and beyond-lithium batteries

Raw material requirements and supply chain considerations

The integration of AI in battery development and production

Technology readiness assessments and commercialization timelines

Application-specific battery selection frameworks

Regional competitive advantages in battery innovation

Material intensity and sustainability considerations

Emerging use cases for specialized battery technologies

Competitive Landscape. The report profiles over 375 companies across the battery value chain, from established manufacturers to innovative start-ups, with detailed analysis of their technology positioning, production capabilities, and strategic partnerships. Companies profiled include 2D Fab AB, 24M Technologies, Inc., 3DOM Inc., 6K Energy, Abound Energy, AC Biode, ACCURE Battery Intelligence, Addionics, Advano, Agora Energy Technologies, Aionics Inc., AirMembrane Corporation, Allegro Energy Pty. Ltd., Alsym Energy, Altairnano / Yinlong, Altris AB, Aluma Power, Altech Batteries Ltd., Ambri, Inc., AMO Greentech, Ampcera, Inc., Amprius, Inc., AMTE Power, Anaphite Limited, Anthro Energy, APB Corporation, Appear Inc., Ateios Systems, Atlas Materials, Australian Advanced Materials, Australian Vanadium Limited, Australia VRFB ESS Company (AVESS), Avanti Battery Company, AZUL Energy Co., Ltd, BAK Power Battery, BASF, BattGenie Inc., Basquevolt, Bedimensional S.p.A, Beijing WeLion New Energy Technology, Bemp Research Company, BenAn Energy Technology, BGT Materials Ltd., Big Power, Biwatt Power, Black Diamond Structures, LLC, Blackstone Resources, Blue Current, Inc., Blue Solutions, Blue Spark Technologies, Inc., Bodi, Inc., Brill Power, BrightVolt, Inc., Broadbit Batteries Oy, BTR New Energy Materials, Inc., BYD Company Limited, Cabot Corporation, California Lithium Battery, CAMX Power, CAPCHEM, CarbonScape Ltd., CBAK Energy Technology, Inc., CCL Design, CEC Science & Technology Co., Ltd, Contemporary Amperex Technology Co Ltd (CATL), CellCube, CellsX, Central Glass Co., Ltd., CENS Materials Ltd., CERQ, Ceylon Graphene Technologies (Pvt) Ltd, Cham Battery Technology, Chasm Advanced Materials, Inc., Chemix, Chengdu Baisige Technology Co., Ltd., China Sodium-ion Times, Citrine Informatics, Clarios, Clim8, CMBlu Energy AG, Connexx Systems Corp, Conovate, Coreshell, Customcells, Cymbet, Daejoo Electronic Materials, Dalian Rongke Power, DFD, Dotz Nano, Dreamweaver International, Eaton Technologies, Ecellix, Echion Technologies, EcoPro BM, ElecJet, Elestor, Elegus Technologies, E-Magy, Energy Storage Industries, Enerpoly AB, Enfucell Oy, Enevate, EnPower Greentech, Enovix, Ensurge Micropower ASA, E-Zinc, Eos Energy, Enzinc, Eonix Energy, ESS Tech, EthonAI, EVE Energy Co., Ltd, Exencell New Energy, Factorial Energy, Faradion

Limited, Farasis Energy, FDK Corporation, Feon Energy, Inc., FinDreams Battery Co., Ltd., FlexEnergy LLC, Flow Aluminum, Inc., Flux XII, Forge Nano, Inc., Forsee Power, Fraunhofer Institute for Electronic Nano Systems (ENAS), Front Edge Technology, Fuelium, Fuji Pigment Co., Ltd., Fujitsu Laboratories Ltd., Corporation Guangzhou Automobile New Energy (GAC), Ganfeng Lithium, GDI, Gelion Technologies Pty Ltd., Geyser Batteries Oy, General Motors (GM), Global Graphene Group, Gnanomat S.L., Gotion High Tech, GQenergy srl, Grafentek, Grafoid, Graphene Batteries AS, Graphene Manufacturing Group Pty Ltd (GMG), Great Power Energy, Green Energy Storage S.r.l. (GES), GRST, Shenzhen Grepow Battery Co., Ltd. (Grepow), Group14 Technologies, Inc., Guoke Tanmei New Materials, GUS Technology, H2 Inc., Hansol Chemical, HE3DA Ltd., Hexalayer LLC, High Performance Battery Holding AG, HiNa Battery Technologies Limited, Hirose Paper Mfg Co., Ltd., HiT Nano, Hitachi Zosen Corporation, Horizontal Na Energy, HPQ Nano Silicon Powders Inc., Hua Na New Materials, Hybrid Kinetic Group, HydraRedox Iberia S.L., IBU-tec Advanced Materials AG, Idemitsu Kosan Co., Ltd., Ilika plc, Indi Energy, INEM Technologies, Inna New Energy, Innolith, InnovationLab, Inobat, Intecells, Intellegens, Invinity Energy Systems, Ionblox, Inc., Ionic Materials, Ionic Mineral Technologies, Ion Storage Systems LLC, Iontra, I-Ten SA, Janaenergy Technology, Jenax, Inc., Jiana Energy, JIOS Aerogel, JNC Corporation, Johnson Energy Storage, Inc., Johnson Matthey, Jolt Energy Storage, JR Energy Solution, Kemiwatt, Kite Rise Technologies GmbH, KoreaGraph, Korid Energy / AVESS, Koura, Kusumoto Chemicals, Largo, Inc., Le System Co., Ltd, Lepu Sodium Power, LeydenJar Technologies, LG Energy Solutions, LiBest, Inc., Libode New Material, LiCAP Technologies, Inc., Li-Fun Technology, Li-Metal Corp, LiNa Energy, LIND Limited, Lionrock Batteries, LionVolt BV, Li-S Energy, Lithium Werks BV, LIVA Power Management Systems GmbH, Lucky Sodium Storage, Lyten, Inc., Merck & Co., Inc., Microvast, Mitsubishi Chemical Corporation, Monolith AI, Moonwat, mPhase Technologies, Murata Manufacturing Co., Ltd., NanoGraf Corporation, Nacoe Energy, nanoFlocell, Nanom, Nanomakers, Nano One Materials, NanoPow AS, Nanoramic Laboratories, Nanoresearch, Inc., Nanotech Energy Inc., Natrium Energy, Natron Energy, Nawa Techonologies, NDB, NEC Corporation, NEI Corporation, Neo Battery Materials Ltd., New Dominion Enterprises, Nexeon, NGK Insulators Ltd., NIO, Inc., Nippon Chemicon, Nippon Electric Glass, Noco-noco, Noon Energy, Nordische Technologies, Novonix, Nuriplan Co., Ltd., Nuvola Technology, Nuvvon, Nyobolt, OneD Battery Sciences, Our Next Energy (ONE), Paraclete Energy, Paragonage, PEAK Energy, Piersica, Pinflow Energy Storage, PJP Eye Ltd., Polarium, PolyJoule, PolyPlus Battery Company, Posco Chemical, PowerCo SE, prelonic technologies, Prieto Battery, Primearth EV Energy Co., Ltd., Prime Batteries Technology, Primus Power, Printed Energy Pty Ltd., ProfMOF AS and more.....

Contents

1 EXECUTIVE SUMMARY

- 1.1 The Li-ion Battery Market in 2025
- 1.2 Global Market Forecasts to 2035
 - 1.2.1 Addressable markets
 - 1.2.2 Li-ion battery pack demand for XEV (GWh)
 - 1.2.3 Li-ion battery market value for XEV (\$B)
 - 1.2.4 Semi-solid-state battery market forecast (GWh)
 - 1.2.5 Semi-solid-state battery market value (\$B)
 - 1.2.6 Solid-state battery market forecast (GWh)
 - 1.2.7 Sodium-ion battery market forecast (GWh)
 - 1.2.8 Sodium-ion battery market value (\$B)
 - 1.2.9 Li-ion battery demand versus beyond Li-ion batteries demand
 - 1.2.10 BEV car cathode forecast (GWh)
 - 1.2.11 BEV anode forecast (GWh)
 - 1.2.12 BEV anode forecast (\$B)
 - 1.2.13 EV cathode forecast (GWh)
 - 1.2.14 EV Anode forecast (GWh)
 - 1.2.15 Advanced anode forecast (GWh)
 - 1.2.16 Advanced anode forecast (\$B)
- 1.3 The global market for advanced Li-ion batteries
 - 1.3.1 Electric vehicles
 - 1.3.1.1 Market overview
 - 1.3.1.2 Battery Electric Vehicles
 - 1.3.1.3 Electric buses, vans and trucks
 - 1.3.1.3.1 Electric medium and heavy duty trucks
 - 1.3.1.3.2 Electric light commercial vehicles (LCVs)
 - 1.3.1.3.3 Electric buses
 - 1.3.1.3.4 Micro EVs
 - 1.3.1.4 Electric off-road
 - 1.3.1.4.1 Construction vehicles
 - 1.3.1.4.2 Electric trains
 - 1.3.1.4.3 Electric boats
 - 1.3.1.5 Market demand and forecasts
 - 1.3.2 Grid storage
 - 1.3.2.1 Market overview
 - 1.3.2.2 Technologies

- 1.3.2.3 Market demand and forecasts
- 1.3.3 Consumer electronics
 - 1.3.3.1 Market overview
 - 1.3.3.2 Technologies
 - 1.3.3.3 Market demand and forecasts
- 1.3.4 Stationary batteries
 - 1.3.4.1 Market overview
 - 1.3.4.2 Technologies
 - 1.3.4.3 Market demand and forecasts
- 1.3.5 Market Forecasts
- 1.4 Market drivers
- 1.5 Battery market megatrends
- 1.6 Advanced materials for batteries
- 1.7 Motivation for battery development beyond lithium
- 1.8 Battery chemistries

2 LI-ION BATTERIES

- 2.1 Types of Lithium Batteries
- 2.2 Anode materials
 - 2.2.1 Graphite
 - 2.2.2 Lithium Titanate
 - 2.2.3 Lithium Metal
 - 2.2.4 Silicon anodes
- 2.3 SWOT analysis
- 2.4 Trends in the Li-ion battery market
- 2.5 Li-ion technology roadmap
- 2.6 Silicon anodes
 - 2.6.1 Benefits
 - 2.6.2 Silicon anode performance
 - 2.6.3 Development in li-ion batteries
 - 2.6.3.1 Manufacturing silicon
 - 2.6.3.2 Commercial production
 - 2.6.3.3 Costs
 - 2.6.3.4 Value chain
 - 2.6.3.5 Markets and applications
 - 2.6.3.5.1 EVs
 - 2.6.3.5.2 Consumer electronics
 - 2.6.3.5.3 Energy Storage

- 2.6.3.5.4 Portable Power Tools
- 2.6.3.5.5 Emergency Backup Power
- 2.6.3.6 Future outlook
- 2.6.4 Consumption
 - 2.6.4.1 By anode material type
 - 2.6.4.2 By end use market
- 2.6.5 Alloy anode materials
- 2.6.6 Silicon-carbon composites
- 2.6.7 Silicon oxides and coatings
- 2.6.8 Carbon nanotubes in Li-ion
- 2.6.9 Graphene coatings for Li-ion
- 2.6.10 Prices
- 2.6.11 Companies
- 2.7 Li-ion electrolytes
- 2.8 Cathodes
 - 2.8.1 Materials
 - 2.8.1.1 High and Ultra-High nickel cathode materials
 - 2.8.1.1.1 Types
 - 2.8.1.1.2 Benefits
 - 2.8.1.1.3 Stability
 - 2.8.1.1.4 Single Crystal Cathodes
 - 2.8.1.1.5 Commercial activity
 - 2.8.1.1.6 Manufacturing
 - 2.8.1.1.7 High manganese content
 - 2.8.1.2 Zero-cobalt NMx
 - 2.8.1.2.1 Overview
 - 2.8.1.2.2 Ultra-high nickel, zero-cobalt cathodes
 - 2.8.1.2.3 Extending the operating voltage
 - 2.8.1.2.4 Operating NMC cathodes at high voltages
 - 2.8.1.3 Lithium-Manganese-Rich (Li-Mn-Rich, LMR-NMC)
 - 2.8.1.3.1 Li-Mn-rich cathodes LMR-NMC
 - 2.8.1.3.2 Stability
 - 2.8.1.3.3 Energy density
 - 2.8.1.3.4 Commercialization
 - 2.8.1.3.5 Hybrid battery chemistry design for manganese-rich
 - 2.8.1.4 Lithium Cobalt Oxide(LiCoO₂) — LCO
 - 2.8.1.5 Lithium Iron Phosphate(LiFePO₄) — LFP
 - 2.8.1.6 Lithium Manganese Oxide (LiMn₂O₄) — LMO
 - 2.8.1.7 Lithium Nickel Manganese Cobalt Oxide (LiNiMnCoO₂) — NMC

- 2.8.1.8 Lithium Nickel Cobalt Aluminum Oxide (LiNiCoAlO₂) — NCA
- 2.8.1.9 Lithium manganese phosphate (LiMnP)
- 2.8.1.10 Lithium manganese iron phosphate (LiMnFePO₄ or LMFP)
 - 2.8.1.10.1 Key characteristics
 - 2.8.1.10.2 LMFP energy density
 - 2.8.1.10.3 Costs
 - 2.8.1.10.4 Saft phosphate-based cathodes
 - 2.8.1.10.5 Commercialization
 - 2.8.1.10.6 Challenges
 - 2.8.1.10.7 LMFP (lithium manganese iron phosphate) market
 - 2.8.1.10.8 Companies
- 2.8.1.11 Lithium nickel manganese oxide (LNMO)
 - 2.8.1.11.1 Overview
 - 2.8.1.11.2 High-voltage spinel cathode LNMO
 - 2.8.1.11.3 LNMO energy density
 - 2.8.1.11.4 Cathode chemistry selection
 - 2.8.1.11.5 LNMO (lithium nickel manganese oxide) high-voltage spinel cathodes cost
- 2.8.1.12 Graphite and LTO
- 2.8.1.13 Silicon
- 2.8.1.14 Lithium metal
- 2.8.2 Alternative Cathode Production
 - 2.8.2.1 Production/Synthesis
 - 2.8.2.2 Commercial development
 - 2.8.2.3 Recycling cathodes
- 2.8.3 Comparison of key lithium-ion cathode materials
- 2.8.4 Emerging cathode material synthesis methods
- 2.8.5 Cathode coatings
- 2.9 Binders and conductive additives
 - 2.9.1 Materials
- 2.10 Separators
 - 2.10.1 Materials
- 2.11 Platinum group metals
- 2.12 Li-ion battery market players
- 2.13 Li-ion recycling
 - 2.13.1 Comparison of recycling techniques
 - 2.13.2 Hydrometallurgy
 - 2.13.2.1 Method overview
 - 2.13.2.1.1 Solvent extraction

- 2.13.2.2 SWOT analysis
- 2.13.3 Pyrometallurgy
 - 2.13.3.1 Method overview
 - 2.13.3.2 SWOT analysis
- 2.13.4 Direct recycling
 - 2.13.4.1 Method overview
 - 2.13.4.1.1 Electrolyte separation
 - 2.13.4.1.2 Separating cathode and anode materials
 - 2.13.4.1.3 Binder removal
 - 2.13.4.1.4 Relithiation
 - 2.13.4.1.5 Cathode recovery and rejuvenation
 - 2.13.4.1.6 Hydrometallurgical-direct hybrid recycling
 - 2.13.4.2 SWOT analysis
- 2.13.5 Other methods
 - 2.13.5.1 Mechanochemical Pretreatment
 - 2.13.5.2 Electrochemical Method
 - 2.13.5.3 Ionic Liquids
- 2.13.6 Recycling of Specific Components
 - 2.13.6.1 Anode (Graphite)
 - 2.13.6.2 Cathode
 - 2.13.6.3 Electrolyte
- 2.13.7 Recycling of Beyond Li-ion Batteries
 - 2.13.7.1 Conventional vs Emerging Processes
- 2.14 Global revenues

3 LITHIUM-METAL BATTERIES

- 3.1 Technology description
- 3.2 Solid-state batteries and lithium metal anodes
- 3.3 Increasing energy density
- 3.4 Lithium-metal anodes
 - 3.4.1 Overview
- 3.5 Challenges
- 3.6 Energy density
- 3.7 Anode-less Cells
 - 3.7.1 Overview
 - 3.7.2 Benefits
 - 3.7.3 Key companies
- 3.8 Lithium-metal and solid-state batteries

- 3.9 Hybrid batteries
- 3.10 Applications
- 3.11 SWOT analysis
- 3.12 Product developers

4 LITHIUM-SULFUR BATTERIES

- 4.1 Technology description
- 4.2 Operating principle of lithium-sulfur (Li-S) batteries
 - 4.2.1 Advantages
 - 4.2.2 Challenges
 - 4.2.3 Commercialization
- 4.3 Costs
- 4.4 Material composition
- 4.5 Lithium intensity
- 4.6 Value chain
- 4.7 Markets
- 4.8 SWOT analysis
- 4.9 Global revenues
- 4.10 Product developers

5 LITHIUM TITANATE OXIDE (LTO) AND NIOBATE BATTERIES

- 5.1 Technology description
 - 5.1.1 Lithium titanate oxide (LTO)
 - 5.1.2 Niobium titanium oxide (NTO)
 - 5.1.2.1 Niobium tungsten oxide
 - 5.1.2.2 Vanadium oxide anodes
- 5.2 Global revenues
- 5.3 Product developers

6 SODIUM-ION (NA-ION) BATTERIES

- 6.1 Technology description
 - 6.1.1 Cathode materials
 - 6.1.1.1 Layered transition metal oxides
 - 6.1.1.1.1 Types
 - 6.1.1.1.2 Cycling performance
 - 6.1.1.1.3 Advantages and disadvantages

- 6.1.1.1.4 Market prospects for LO SIB
- 6.1.1.2 Polyanionic materials
 - 6.1.1.2.1 Advantages and disadvantages
 - 6.1.1.2.2 Types
 - 6.1.1.2.3 Market prospects for Poly SIB
- 6.1.1.3 Prussian blue analogues (PBA)
 - 6.1.1.3.1 Types
 - 6.1.1.3.2 Advantages and disadvantages
 - 6.1.1.3.3 Market prospects for PBA-SIB
- 6.1.2 Anode materials
 - 6.1.2.1 Hard carbons
 - 6.1.2.2 Carbon black
 - 6.1.2.3 Graphite
 - 6.1.2.4 Carbon nanotubes
 - 6.1.2.5 Graphene
 - 6.1.2.6 Alloying materials
 - 6.1.2.7 Sodium Titanates
 - 6.1.2.8 Sodium Metal
- 6.1.3 Electrolytes
- 6.2 Comparative analysis with other battery types
- 6.3 Cost comparison with Li-ion
- 6.4 Materials in sodium-ion battery cells
- 6.5 SWOT analysis
- 6.6 Global revenues
- 6.7 Product developers
 - 6.7.1 Battery Manufacturers
 - 6.7.2 Large Corporations
 - 6.7.3 Automotive Companies
 - 6.7.4 Chemicals and Materials Firms

7 SODIUM-SULFUR BATTERIES

- 7.1 Technology description
- 7.2 Applications
- 7.3 SWOT analysis

8 ALUMINIUM-ION BATTERIES

- 8.1 Technology description

- 8.2 SWOT analysis
- 8.3 Commercialization
- 8.4 Global revenues
- 8.5 Product developers

9 SOLID STATE BATTERIES

- 9.1 Technology description
 - 9.1.1 Solid-state electrolytes
- 9.2 Features and advantages
- 9.3 Technical specifications
- 9.4 Types
- 9.5 Microbatteries
 - 9.5.1 Introduction
 - 9.5.2 Materials
 - 9.5.3 Applications
 - 9.5.4 3D designs
 - 9.5.4.1 3D printed batteries
- 9.6 Bulk type solid-state batteries
- 9.7 SWOT analysis
- 9.8 Limitations
- 9.9 Global revenues
- 9.10 Product developers

10 FLEXIBLE BATTERIES

- 10.1 Technology description
- 10.2 Technical specifications
 - 10.2.1 Approaches to flexibility
- 10.3 Flexible electronics
- 10.4 Flexible materials
- 10.5 Flexible and wearable Metal-sulfur batteries
- 10.6 Flexible and wearable Metal-air batteries
- 10.7 Flexible Lithium-ion Batteries
 - 10.7.1 Types of Flexible/stretchable LIBs
 - 10.7.1.1 Flexible planar LiBs
 - 10.7.1.2 Flexible Fiber LiBs
 - 10.7.1.3 Flexible micro-LiBs
 - 10.7.1.4 Stretchable lithium-ion batteries

- 10.7.1.5 Origami and kirigami lithium-ion batteries
- 10.8 Flexible Li/S batteries
 - 10.8.1 Components
 - 10.8.2 Carbon nanomaterials
- 10.9 Flexible lithium-manganese dioxide (Li–MnO₂) batteries
- 10.10 Flexible zinc-based batteries
 - 10.10.1 Components
 - 10.10.1.1 Anodes
 - 10.10.1.2 Cathodes
 - 10.10.2 Challenges
 - 10.10.3 Flexible zinc-manganese dioxide (Zn–Mn) batteries
 - 10.10.4 Flexible silver–zinc (Ag–Zn) batteries
 - 10.10.5 Flexible Zn–Air batteries
 - 10.10.6 Flexible zinc-vanadium batteries
- 10.11 Fiber-shaped batteries
 - 10.11.1 Carbon nanotubes
 - 10.11.2 Types
 - 10.11.3 Applications
 - 10.11.4 Challenges
- 10.12 Energy harvesting combined with wearable energy storage devices
- 10.13 SWOT analysis
- 10.14 Global revenues
- 10.15 Product developers

11 TRANSPARENT BATTERIES

- 11.1 Technology description
- 11.2 Components
- 11.3 SWOT analysis
- 11.4 Market outlook

12 DEGRADABLE BATTERIES

- 12.1 Technology description
- 12.2 Components
- 12.3 SWOT analysis
- 12.4 Market outlook
- 12.5 Product developers

13 PRINTED BATTERIES

- 13.1 Technical specifications
- 13.2 Components
- 13.3 Design
- 13.4 Key features
- 13.5 Printable current collectors
- 13.6 Printable electrodes
- 13.7 Materials
- 13.8 Applications
- 13.9 Printing techniques
- 13.10 Lithium-ion (LIB) printed batteries
- 13.11 Zinc-based printed batteries
- 13.12 3D Printed batteries
 - 13.12.1 3D Printing techniques for battery manufacturing
 - 13.12.2 Materials for 3D printed batteries
 - 13.12.2.1 Electrode materials
 - 13.12.2.2 Electrolyte Materials
- 13.13 SWOT analysis
- 13.14 Global revenues
- 13.15 Product developers

14 REDOX FLOW BATTERIES

- 14.1 Technology description
- 14.2 Types
 - 14.2.1 Vanadium redox flow batteries (VRFB)
 - 14.2.1.1 Technology description
 - 14.2.1.2 SWOT analysis
 - 14.2.1.3 Market players
 - 14.2.2 Zinc-bromine flow batteries (ZnBr)
 - 14.2.2.1 Technology description
 - 14.2.2.2 SWOT analysis
 - 14.2.2.3 Market players
 - 14.2.3 Polysulfide bromine flow batteries (PSB)
 - 14.2.3.1 Technology description
 - 14.2.3.2 SWOT analysis
 - 14.2.4 Iron-chromium flow batteries (ICB)
 - 14.2.4.1 Technology description

- 14.2.4.2 SWOT analysis
- 14.2.4.3 Market players
- 14.2.5 All-Iron flow batteries
 - 14.2.5.1 Technology description
 - 14.2.5.2 SWOT analysis
 - 14.2.5.3 Market players
- 14.2.6 Zinc-iron (Zn-Fe) flow batteries
 - 14.2.6.1 Technology description
 - 14.2.6.2 SWOT analysis
 - 14.2.6.3 Market players
- 14.2.7 Hydrogen-bromine (H-Br) flow batteries
 - 14.2.7.1 Technology description
 - 14.2.7.2 SWOT analysis
 - 14.2.7.3 Market players
- 14.2.8 Hydrogen-Manganese (H-Mn) flow batteries
 - 14.2.8.1 Technology description
 - 14.2.8.2 SWOT analysis
 - 14.2.8.3 Market players
- 14.2.9 Organic flow batteries
 - 14.2.9.1 Technology description
 - 14.2.9.2 SWOT analysis
 - 14.2.9.3 Market players
- 14.2.10 Emerging Flow-Batteries
 - 14.2.10.1 Semi-Solid Redox Flow Batteries
 - 14.2.10.2 Solar Redox Flow Batteries
 - 14.2.10.3 Air-Breathing Sulfur Flow Batteries
 - 14.2.10.4 Metal-CO₂ Batteries
- 14.2.11 Hybrid Flow Batteries
 - 14.2.11.1 Zinc-Cerium Hybrid Flow Batteries
 - 14.2.11.1.1 Technology description
 - 14.2.11.2 Zinc-Polyiodide Flow Batteries
 - 14.2.11.2.1 Technology description
 - 14.2.11.3 Zinc-Nickel Hybrid Flow Batteries
 - 14.2.11.3.1 Technology description
 - 14.2.11.4 Zinc-Bromine Hybrid Flow Batteries
 - 14.2.11.4.1 Technology description
 - 14.2.11.5 Vanadium-Polyhalide Flow Batteries
 - 14.2.11.5.1 Technology description
- 14.3 Markets for redox flow batteries

14.4 Global revenues

15 ZN-BASED BATTERIES

15.1 Technology description

15.1.1 Zinc-Air batteries

15.1.2 Zinc-ion batteries

15.1.3 Zinc-bromide

15.2 Market outlook

15.3 Product developers

16 AI BATTERY TECHNOLOGY

16.1 Overview

16.2 Applications

16.2.1 Machine Learning

16.2.1.1 Overview

16.2.2 Material Informatics

16.2.2.1 Overview

16.2.2.2 Companies

16.2.3 Cell Testing

16.2.3.1 Overview

16.2.3.2 Companies

16.2.4 Cell Assembly and Manufacturing

16.2.4.1 Overview

16.2.4.2 Companies

16.2.5 Battery Analytics

16.2.5.1 Overview

16.2.5.2 Companies

16.2.6 Second Life Assessment

16.2.6.1 Overview

16.2.6.2 Companies

17 PRINTED SUPERCAPACITORS

17.1 Overview

17.2 Printing methods

17.3 Electrode materials

17.4 Electrolytes

18 CELL AND BATTERY DESIGN

18.1 Cell Design

18.1.1 Overview

18.1.1.1 Larger cell formats

18.1.1.2 Bipolar battery architecture

18.1.1.3 Thick Format Electrodes

18.1.1.4 Dual Electrolyte Li-ion

18.1.2 Commercial examples

18.1.2.1 Tesla 4680 Tabless Cell

18.1.2.2 EnPower multi-layer electrode technology

18.1.2.3 Prieto Battery

18.1.2.4 Addionics

18.1.3 Electrolyte Additives

18.1.4 Enhancing battery performance

18.2 Cell Performance

18.2.1 Energy density

18.2.1.1 BEV cell energy

18.2.1.2 Cell energy density

18.3 Battery Packs

18.3.1 Cell-to-pack

18.3.2 Cell-to-chassis/body

18.3.3 Bipolar batteries

18.3.4 Hybrid battery packs

18.3.4.1 CATL

18.3.4.2 Our Next Energy

18.3.4.3 Nio

18.3.5 Battery Management System (BMS)

18.3.5.1 Overview

18.3.5.2 Advantages

18.3.5.3 Innovation

18.3.5.4 Fast charging capabilities

18.3.5.5 Wireless Battery Management System technology

19 COMPANY PROFILES 428 (377 COMPANY PROFILES)

20 RESEARCH METHODOLOGY

20.1 Report scope

20.2 Research methodology

21 REFERENCES

List Of Tables

LIST OF TABLES

- Table 1. Trends in the Li-ion market in 2025.
- Table 2. Total Addressable Market for Li-ion Batteries.
- Table 3. Li-ion battery pack demand for XEV (GWh) 2019-2035.
- Table 4. Li-ion battery market value for XEV (in \$B) 2019-2035.
- Table 5. Semi-solid-state battery market forecast (GWh) 2019-2035.
- Table 6. Semi-solid-state battery market forecast, GWh, by electrolyte types 2019-2035.
- Table 7. Semi-solid-state battery market value (\$B) 2019-2035.
- Table 8. Solid-state battery market forecast (GWh) 2019-2035.
- Table 9. Solid-state battery market forecast, GWh, by electrolyte types 2019-2035.
- Table 10. Sodium-ion battery market forecast (GWh) 2019-2035.
- Table 11. Sodium-ion battery market value (\$B) 2019-2035.
- Table 12. Li-ion battery demand versus beyond Li-ion batteries demand 2019-2035.
- Table 13. BEV car cathode forecast (GWh) 2019-2035.
- Table 14. BEV anode forecast (GWh) 2019-2035.
- Table 15. BEV anode forecast (\$B) 2019-2035.
- Table 16. EV cathode forecast (GWh) 2019-2035.
- Table 17. EV Anode forecast (GWh) 2019-2035.
- Table 18. Advanced anode forecast (GWh) 2019-2035.
- Table 19. Advanced anode forecast (\$B) 2019-2035.
- Table 20. Annual sales of battery electric vehicles and plug-in hybrid electric vehicles.
- Table 21. Battery chemistries used in electric buses.
- Table 22. Micro EV types
- Table 23. Battery Sizes for Different Vehicle Types.
- Table 24. Competing technologies for batteries in electric boats.
- Table 25. Electric car Li-ion demand forecast (GWh), 2018-2035.
- Table 26. EV Li-ion battery market (US\$B), 2018-2035.
- Table 27. Electric bus, truck and van battery forecast (GWh), 2018-2035.
- Table 28. Micro EV Li-ion demand forecast (GWh).
- Table 29. Competing technologies for batteries in grid storage.
- Table 30. Lithium-ion battery grid storage demand forecast (GWh), 2018-2035.
- Table 31. Competing technologies for batteries in consumer electronics
- Table 32. Competing technologies for sodium-ion batteries in grid storage.
- Table 33. Total Addressable Markets (GWh) for Advanced Li-ion and Beyond Li-ion Batteries.
- Table 34. BEV Car Cathode Forecast (GWh).

Table 35. BEV Anode Forecast (GWh) 2019-2035.
Table 36. BEV Anode Forecast (\$B) 2019-2035.
Table 37. EV Cathode Forecast (GWh) 2019-2035
Table 38. EV Anode Forecast (GWh) 2019-2035.
Table 39. Advanced Anode Forecast (GWh) 2019-2035.
Table 40. Advanced Anode Forecast (\$B) 2019-2035
Table 41. Market drivers for use of advanced materials and technologies in batteries.
Table 42. Battery market megatrends.
Table 43. Advanced materials for batteries.
Table 44. Commercial Li-ion battery cell composition.
Table 45. Lithium-ion (Li-ion) battery supply chain.
Table 46. Types of lithium battery.
Table 47. Comparison of Li-ion battery anode materials.
Table 48. Trends in the Li-ion battery market.
Table 49. Si-anode performance summary.
Table 50. Manufacturing methods for nano-silicon anodes.
Table 51. Market Players' Production Capacities.
Table 52. Strategic Partnerships and Agreements.
Table 53. Markets and applications for silicon anodes.
Table 54. Anode material consumption by type (tonnes).
Table 55. Anode material consumption by end use market (tonnes).
Table 56. Anode materials prices, current and forecasted (USD/kg).
Table 57. Silicon-anode companies.
Table 58. Li-ion battery cathode materials.
Table 59. Key technology trends shaping lithium-ion battery cathode development.
Table 60. Benefits of High and Ultra-High Nickel NMC.
Table 61. Routes to High Nickel Cathode Stabilisation
Table 62. High-nickel Products Table.
Table 63. Li-Mn-rich / lithium-manganese-rich / LMR-NMC costs.
Table 64. Commercial lithium-manganese-rich cathode development.
Table 65. Lithium-manganese-rich cathode developers
Table 66. Properties of Lithium Cobalt Oxide) as a cathode material for lithium-ion batteries.
Table 67. Properties of lithium iron phosphate (LiFePO ₄ or LFP) as a cathode material for lithium-ion batteries.
Table 68. Properties of Lithium Manganese Oxide cathode material.
Table 69. Properties of Lithium Nickel Manganese Cobalt Oxide (NMC).
Table 70. Properties of Lithium Nickel Cobalt Aluminum Oxide
Table 71. LMFP Cell Performance.

Table 72. LMFP Energy Density Analysis
Table 73. LMFP Cost Analysis
Table 74. LMFP Cathode Developers.
Table 75. LNMO Performance.
Table 76. LNMO Energy Density Comparison
Table 77. Alternative Cathode Production Routes.
Table 78. Alternative cathode synthesis routes.
Table 79. Alternative Cathode Production Companies.
Table 80. Recycled cathode materials facilities and capacities.
Table 81. Comparison table of key lithium-ion cathode materials
Table 82. Li-ion battery Binder and conductive additive materials.
Table 83. Li-ion battery Separator materials.
Table 84. Li-ion battery market players.
Table 85. Typical lithium-ion battery recycling process flow.
Table 86. Main feedstock streams that can be recycled for lithium-ion batteries.
Table 87. Comparison of LIB recycling methods.
Table 88. Comparison of conventional and emerging processes for recycling beyond lithium-ion batteries.
Table 89. Global revenues for Li-ion batteries, 2018-2035, by market (Billions USD).
Table 90. Anode-less lithium-metal cell benefits.
Table 91. Anode-less lithium-metal cell developers.
Table 92. Hybrid Battery Technologies
Table 93. Applications for Li-metal batteries.
Table 94. Li-metal battery developers
Table 95. Li-S performance characteristics.
Table 96. Comparison of the theoretical energy densities of lithium-sulfur batteries versus other common battery types.
Table 97. Challenges with lithium-sulfur.
Table 98. Li-S advantages and use cases
Table 99. Global revenues for Lithium-sulfur, 2018-2035, by market (Billions USD).
Table 100. Lithium-sulphur battery product developers.
Table 101. Global revenues for Lithium titanate and niobate batteries, 2018-2035, by market (Billions USD).
Table 102. Product developers in Lithium titanate and niobate batteries.
Table 103. Comparison of cathode materials.
Table 104. Layered transition metal oxide cathode materials for sodium-ion batteries.
Table 105. General cycling performance characteristics of common layered transition metal oxide cathode materials.
Table 106. Polyanionic materials for sodium-ion battery cathodes.

- Table 107. Comparative analysis of different polyanionic materials.
- Table 108. Common types of Prussian Blue Analogue materials used as cathodes or anodes in sodium-ion batteries.
- Table 109. Comparison of Na-ion battery anode materials.
- Table 110. Hard Carbon producers for sodium-ion battery anodes.
- Table 111. Comparison of carbon materials in sodium-ion battery anodes.
- Table 112. Comparison between Natural and Synthetic Graphite.
- Table 113. Properties of graphene, properties of competing materials, applications thereof.
- Table 114. Comparison of carbon based anodes.
- Table 115. Alloying materials used in sodium-ion batteries.
- Table 116. Na-ion electrolyte formulations.
- Table 117. Pros and cons compared to other battery types.
- Table 118. Cost comparison with Li-ion batteries.
- Table 119. Key materials in sodium-ion battery cells.
- Table 120. Global revenues for sodium-ion batteries, 2018-2035, by market (Billions USD).
- Table 121. Product developers in aluminium-ion batteries.
- Table 122. Types of solid-state electrolytes.
- Table 123. Market segmentation and status for solid-state batteries.
- Table 124. Solid Electrolyte Material Comparison.
- Table 125. Typical process chains for manufacturing key components and assembly of solid-state batteries.
- Table 126. Comparison between liquid and solid-state batteries.
- Table 127. Limitations of solid-state thin film batteries.
- Table 128. Solid-state battery market forecast (GWh) 2019-2035.
- Table 129. Solid-state battery market forecast, GWh, by electrolyte types 2019-2035.
- Table 130. Solid-state thin-film battery market players.
- Table 131. Flexible battery applications and technical requirements.
- Table 132. Comparison of Flexible and Traditional Lithium-Ion Batteries
- Table 133. Material Choices for Flexible Battery Components.
- Table 134. Flexible Li-ion battery prototypes.
- Table 135. Thin film vs bulk solid-state batteries.
- Table 136. Summary of fiber-shaped lithium-ion batteries.
- Table 137. Types of fiber-shaped batteries.
- Table 138. Global revenues for flexible batteries, 2018-2035, by market (Billions USD).
- Table 139. Product developers in flexible batteries.
- Table 140. Components of transparent batteries.
- Table 141. Components of degradable batteries.

- Table 142. Product developers in degradable batteries.
- Table 143. Main components and properties of different printed battery types.
- Table 144. Applications of printed batteries and their physical and electrochemical requirements.
- Table 145. 2D and 3D printing techniques.
- Table 146. Printing techniques applied to printed batteries.
- Table 147. Main components and corresponding electrochemical values of lithium-ion printed batteries.
- Table 148. Printing technique, main components and corresponding electrochemical values of printed batteries based on Zn–MnO₂ and other battery types.
- Table 149. Main 3D Printing techniques for battery manufacturing.
- Table 150. Electrode Materials for 3D Printed Batteries.
- Table 151. Global revenues for printed batteries, 2018-2035, by market (Billions USD).
- Table 152. Product developers in printed batteries.
- Table 153. Advantages and disadvantages of redox flow batteries.
- Table 154. Comparison of different battery types.
- Table 155. Summary of main flow battery types.
- Table 156. Vanadium redox flow batteries (VRFB)-key features, advantages, limitations, performance, components and applications.
- Table 157. Market players in Vanadium redox flow batteries (VRFB).
- Table 158. Zinc-bromine (ZnBr) flow batteries-key features, advantages, limitations, performance, components and applications.
- Table 159. Market players in Zinc-Bromine Flow Batteries (ZnBr).
- Table 160. Polysulfide bromine flow batteries (PSB)-key features, advantages, limitations, performance, components and applications.
- Table 161. Iron-chromium (ICB) flow batteries-key features, advantages, limitations, performance, components and applications.
- Table 162. Market players in Iron-chromium (ICB) flow batteries.
- Table 163. All-Iron flow batteries-key features, advantages, limitations, performance, components and applications.
- Table 164. Market players in All-iron Flow Batteries.
- Table 165. Zinc-iron (Zn-Fe) flow batteries-key features, advantages, limitations, performance, components and applications.
- Table 166. Market players in Zinc-iron (Zn-Fe) Flow Batteries.
- Table 167. Hydrogen-bromine (H-Br) flow batteries-key features, advantages, limitations, performance, components and applications.
- Table 168. Market players in Hydrogen-bromine (H-Br) flow batteries.
- Table 169. Hydrogen-Manganese (H-Mn) flow batteries-key features, advantages, limitations, performance, components and applications.

Table 170. Market players in Hydrogen-Manganese (H-Mn) Flow Batteries.
Table 171. Materials in Organic Redox Flow Batteries (ORFB).
Table 172. Key Active species for ORFBs
Table 173. Organic flow batteries-key features, advantages, limitations, performance, components and applications.
Table 174. Market players in Organic Redox Flow Batteries (ORFB).
Table 175. Zinc-Cerium Hybrid flow batteries-key features, advantages, limitations, performance, components and applications.
Table 176. Zinc-Polyiodide Hybrid Flow batteries-key features, advantages, limitations, performance, components and applications.
Table 177. Zinc-Nickel Hybrid Flow batteries-key features, advantages, limitations, performance, components and applications.
Table 178. Zinc-Bromine Hybrid Flow batteries-key features, advantages, limitations, performance, components and applications.
Table 179. Vanadium-Polyhalide Hybrid Flow batteries-key features, advantages, limitations, performance, components and applications.
Table 180. Redox flow battery value chain.
Table 181. Global revenues for redox flow batteries, 2018-2035, by type (millions USD).
Table 182. ZN-based battery product developers.
Table 183. Application of Artificial Intelligence (AI) in battery technology.
Table 184. Machine learning approaches.
Table 185. Types of Neural Networks.
Table 186. Companies in materials informatics for batteries.
Table 187. Data Forms for Cell Modelling.
Table 188. Algorithmic Approaches for Different Testing Modes.
Table 189. Companies in AI for cell testing for batteries.
Table 190. Algorithmic Approaches in Manufacturing and Cell Assembly:
Table 191. AI-based battery manufacturing players.
Table 192. Companies in AI for battery diagnostics and management.
Table 193. Algorithmic Approaches and Data Inputs/Outputs.
Table 194. Companies in AI for second-life battery assessment
Table 195. Methods for printing supercapacitors.
Table 196. Electrode Materials for printed supercapacitors.
Table 197. Electrolytes for printed supercapacitors.
Table 198. Main properties and components of printed supercapacitors.
Table 199. Electrolyte Additives.
Table 200. Cell performance specification.
Table 201. Commercial cell chemistries
Table 202. Drivers and Challenges for Cell-to-pack.

Table 203. Cell-to-pack and cell-to-body designs.

Table 204. 3DOM separator.

Table 205. CATL sodium-ion battery characteristics.

Table 206. CHAM sodium-ion battery characteristics.

Table 207. Chasm SWCNT products.

Table 208. Faradion sodium-ion battery characteristics.

Table 209. HiNa Battery sodium-ion battery characteristics.

Table 210. Battery performance test specifications of J. Flex batteries.

Table 211. LiNa Energy battery characteristics.

Table 212. Natrium Energy battery characteristics.

List Of Figures

LIST OF FIGURES

- Figure 1. Li-ion battery pack demand for XEV (in GWh) 2019-2035
- Figure 2. Li-ion battery market value for XEV (in \$B) 2019-2035.
- Figure 3. Semi-solid-state battery market forecast (GWh) 2019-2035.
- Figure 4. Semi-solid-state battery market forecast, GWh, by electrolyte types 2019-2035.
- Figure 5. Semi-solid-state battery market value (\$B) 2019-2035.
- Figure 6. Solid-state battery market forecast (GWh) 2019-2035.
- Figure 7. Solid-state battery market forecast, GWh, by electrolyte types 2019-2035.
- Figure 8. Sodium-ion battery market forecast (GWh) 2019-2035.
- Figure 9. Sodium-ion battery market value (\$B) 2019-2035.
- Figure 10. BEV car cathode forecast (GWh) 2019-2035.
- Figure 11. BEV anode forecast (GWh) 2019-2035.
- Figure 12. BEV anode forecast (\$B) 2019-2035.
- Figure 13. EV cathode forecast (GWh) 2019-2035.
- Figure 14. EV Anode forecast (GWh) 2019-2035.
- Figure 15. Advanced anode forecast (GWh) 2019-2035.
- Figure 16. Figure 17. Advanced anode forecast (\$B) 2019-2035.
- Figure 18. Electric bus, truck and van battery forecast (GWh), 2018-2035.
- Figure 19. Micro EV Li-ion demand forecast (GWh).
- Figure 20. Lithium-ion battery grid storage demand forecast (GWh), 2018-2035.
- Figure 21. Salt-E Dog mobile battery.
- Figure 22. I.Power Nest - Residential Energy Storage System Solution.
- Figure 23. Costs of batteries to 2030.
- Figure 24. Lithium Cell Design.
- Figure 25. Functioning of a lithium-ion battery.
- Figure 26. Li-ion battery cell pack.
- Figure 27. Li-ion electric vehicle (EV) battery.
- Figure 28. SWOT analysis: Li-ion batteries.
- Figure 29. Li-ion technology roadmap.
- Figure 30. Silicon anode value chain.
- Figure 31. Market development timeline.
- Figure 32. Silicon Anode Commercialization Timeline.
- Figure 33. Silicon anode value chain.
- Figure 34. Anode material consumption by type (tonnes).
- Figure 35. Anode material consumption by end user market (tonnes).

- Figure 36. Ultra-high Nickel Cathode Commercialization Timeline.
- Figure 37. Lithium-manganese-rich cathode SWOT analysis.
- Figure 38. Li-cobalt structure.
- Figure 39. Li-manganese structure.
- Figure 40. LNMO cathode SWOT.
- Figure 41. Typical direct, pyrometallurgical, and hydrometallurgical recycling methods for recovery of Li-ion battery active materials.
- Figure 42. Flow chart of recycling processes of lithium-ion batteries (LIBs).
- Figure 43. Hydrometallurgical recycling flow sheet.
- Figure 44. SWOT analysis for Hydrometallurgy Li-ion Battery Recycling.
- Figure 45. Umicore recycling flow diagram.
- Figure 46. SWOT analysis for Pyrometallurgy Li-ion Battery Recycling.
- Figure 47. Schematic of direct recycling process.
- Figure 48. SWOT analysis for Direct Li-ion Battery Recycling.
- Figure 49. Global revenues for Li-ion batteries, 2018-2035, by market (Billions USD).
- Figure 50. Schematic diagram of a Li-metal battery.
- Figure 51. SWOT analysis: Lithium-metal batteries.
- Figure 52. Schematic diagram of Lithium–sulfur battery.
- Figure 53. Lithium-sulfur market value chain.
- Figure 54. SWOT analysis: Lithium-sulfur batteries.
- Figure 55. Global revenues for Lithium-sulfur, 2018-2035, by market (Billions USD).
- Figure 56. Global revenues for Lithium titanate and niobate batteries, 2018-2035, by market (Billions USD).
- Figure 57. Schematic of Prussian blue analogues (PBA).
- Figure 58. Comparison of SEM micrographs of sphere-shaped natural graphite (NG; after several processing steps) and synthetic graphite (SG).
- Figure 59. Overview of graphite production, processing and applications.
- Figure 60. Schematic diagram of a multi-walled carbon nanotube (MWCNT).
- Figure 61. Schematic diagram of a Na-ion battery.
- Figure 62. SWOT analysis: Sodium-ion batteries.
- Figure 63. Global revenues for sodium-ion batteries, 2018-2035, by market (Billions USD).
- Figure 64. Schematic of a Na–S battery.
- Figure 65. SWOT analysis: Sodium-sulfur batteries.
- Figure 66. Saturnose battery chemistry.
- Figure 67. SWOT analysis: Aluminium-ion batteries.
- Figure 68. Global revenues for aluminium-ion batteries, 2018-2035, by market (Billions USD).
- Figure 69. Schematic illustration of all-solid-state lithium battery.

- Figure 70. ULTRALIFE thin film battery.
- Figure 71. Examples of applications of thin film batteries.
- Figure 72. Capacities and voltage windows of various cathode and anode materials.
- Figure 73. Traditional lithium-ion battery (left), solid state battery (right).
- Figure 74. Bulk type compared to thin film type SSB.
- Figure 75. SWOT analysis: All-solid state batteries.
- Figure 76. Solid-state battery market forecast (GWh) 2019-2035.
- Figure 77. Ragone plots of diverse batteries and the commonly used electronics powered by flexible batteries.
- Figure 78. Various architectures for flexible and stretchable electrochemical energy storage.
- Figure 79. Types of flexible batteries.
- Figure 80. Flexible batteries on the market.
- Figure 81. Materials and design structures in flexible lithium ion batteries.
- Figure 82. Flexible/stretchable LIBs with different structures.
- Figure 83. a–c) Schematic illustration of coaxial (a), twisted (b), and stretchable (c) LIBs.
- Figure 84. a) Schematic illustration of the fabrication of the superstretchy LIB based on an MWCNT/LMO composite fiber and an MWCNT/LTO composite fiber. b,c) Photograph (b) and the schematic illustration (c) of a stretchable fiber-shaped battery under stretching conditions. d) Schematic illustration of the spring-like stretchable LIB. e) SEM images of a fiber at different strains. f) Evolution of specific capacitance with strain. d–f)
- Figure 85. Origami disposable battery.
- Figure 86. Zn–MnO₂ batteries produced by Brightvolt.
- Figure 87. Charge storage mechanism of alkaline Zn-based batteries and zinc-ion batteries.
- Figure 88. Zn–MnO₂ batteries produced by Blue Spark.
- Figure 89. Ag–Zn batteries produced by Imprint Energy.
- Figure 90. Wearable self-powered devices.
- Figure 91. SWOT analysis: Flexible batteries.
- Figure 92. Global revenues for flexible batteries, 2018-2035, by market (Billions USD).
- Figure 93. Transparent batteries.
- Figure 94. SWOT analysis: Transparent batteries.
- Figure 95. Degradable batteries.
- Figure 96. SWOT analysis: Degradable batteries.
- Figure 97. Various applications of printed paper batteries.
- Figure 98. Schematic representation of the main components of a battery.
- Figure 99. Schematic of a printed battery in a sandwich cell architecture, where the anode and cathode of the battery are stacked together.

Figure 100. Manufacturing Processes for Conventional Batteries (I), 3D Microbatteries (II), and 3D-Printed Batteries (III).

Figure 101. SWOT analysis: Printed batteries.

Figure 102. Global revenues for printed batteries, 2018-2035, by market (Billions USD).

Figure 103. Scheme of a redox flow battery.

Figure 104. Vanadium Redox Flow Battery schematic.

Figure 105. SWOT analysis: Vanadium redox flow batteries (VRFB)

Figure 106. Schematic of zinc bromine flow battery energy storage system.

Figure 107. SWOT analysis: Zinc-Bromine Flow Batteries (ZnBr).

Figure 108. SWOT analysis: Iron-chromium (ICB) flow batteries.

Figure 109. SWOT analysis: Iron-chromium (ICB) flow batteries.

Figure 110. Schematic of All-Iron Redox Flow Batteries.

Figure 111. SWOT analysis: All-iron Flow Batteries.

Figure 112. SWOT analysis: Zinc-iron (Zn-Fe) flow batteries.

Figure 113. Schematic of Hydrogen-bromine flow battery.

Figure 114. SWOT analysis: Hydrogen-bromine (H-Br) flow batteries.

Figure 115. SWOT analysis: Hydrogen-Manganese (H-Mn) flow batteries.

Figure 116. SWOT analysis: Organic redox flow batteries (ORFBs) batteries.

Figure 117. Schematic of zinc-polyiodide redox flow battery (ZIB).

Figure 118. Redox flow batteries applications roadmap.

Figure 119. Global revenues for redox flow batteries, 2018-2035, by type (millions USD).

Figure 120. Main printing methods for supercapacitors.

Figure 121. Types of integrated battery packs

Figure 122. Battery pack with a cell-to-pack design and prismatic cells.

Figure 123. 24M battery.

Figure 124. 3DOM battery.

Figure 125. AC biode prototype.

Figure 126. Schematic diagram of liquid metal battery operation.

Figure 127. Ampcera's all-ceramic dense solid-state electrolyte separator sheets (25 μ m thickness, 50mm x 100mm size, flexible and defect free, room temperature ionic conductivity \sim 1 mA/cm).

Figure 128. Amprius battery products.

Figure 129. All-polymer battery schematic.

Figure 130. All Polymer Battery Module.

Figure 131. Resin current collector.

Figure 132. Ateios thin-film, printed battery.

Figure 133. The structure of aluminum-sulfur battery from Avanti Battery.

Figure 134. Containerized NAS® batteries.

- Figure 135. 3D printed lithium-ion battery.
- Figure 136. Blue Solution module.
- Figure 137. TempTraq wearable patch.
- Figure 138. Schematic of a fluidized bed reactor which is able to scale up the generation of SWNTs using the CoMoCAT process.
- Figure 139. Carhartt X-1 Smart Heated Vest.
- Figure 140. Cymbet EnerChip™
- Figure 141. Rongke Power 400 MWh VRFB.
- Figure 142. E-magy nano sponge structure.
- Figure 143. Enerpoly zinc-ion battery.
- Figure 144. SoftBattery®.
- Figure 145. ASSB All-Solid-State Battery by EGI 300 Wh/kg.
- Figure 146. Roll-to-roll equipment working with ultrathin steel substrate.
- Figure 147. 40 Ah battery cell.
- Figure 148. FDK Corp battery.
- Figure 149. 2D paper batteries.
- Figure 150. 3D Custom Format paper batteries.
- Figure 151. Fuji carbon nanotube products.
- Figure 152. Gelion Endure battery.
- Figure 153. Gelion GEN3 lithium sulfur batteries.
- Figure 154. Grepow flexible battery.
- Figure 155. HPB solid-state battery.
- Figure 156. HiNa Battery pack for EV.
- Figure 157. JAC demo EV powered by a HiNa Na-ion battery.
- Figure 158. Nanofiber Nonwoven Fabrics from Hirose.
- Figure 159. Hitachi Zosen solid-state battery.
- Figure 160. Ilika solid-state batteries.
- Figure 161. TAeTTOOz printable battery materials.
- Figure 162. Ionic Materials battery cell.
- Figure 163. Schematic of Ion Storage Systems solid-state battery structure.
- Figure 164. ITEN micro batteries.
- Figure 165. Kite Rise's A-sample sodium-ion battery module.
- Figure 166. LiBEST flexible battery.
- Figure 167. Li-FUN sodium-ion battery cells.
- Figure 168. LiNa Energy battery.
- Figure 169. 3D solid-state thin-film battery technology.
- Figure 170. Lyten batteries.
- Figure 171. Cellulomix production process.
- Figure 172. Nanobase versus conventional products.

- Figure 173. Nanotech Energy battery.
- Figure 174. Hybrid battery powered electrical motorbike concept.
- Figure 175. NBD battery.
- Figure 176. Schematic illustration of three-chamber system for SWCNH production.
- Figure 177. TEM images of carbon nanobrush.
- Figure 178. EnerCerachip.
- Figure 179. Cambrian battery.
- Figure 180. Printed battery.
- Figure 181. Prieto Foam-Based 3D Battery.
- Figure 182. Printed Energy flexible battery.
- Figure 183. ProLogium solid-state battery.
- Figure 184. QingTao solid-state batteries.
- Figure 185. Schematic of the quinone flow battery.
- Figure 186. Saku? Corporation 3Ah Lithium Metal Solid-state Battery.
- Figure 187. Salgenx S3000 seawater flow battery.
- Figure 188. Samsung SDI's sixth-generation prismatic batteries.
- Figure 189. SES Apollo batteries.
- Figure 190. Sionic Energy battery cell.
- Figure 191. Solid Power battery pouch cell.
- Figure 192. Stora Enso lignin battery materials.
- Figure 193. TeraWatt Technology solid-state battery
- Figure 194. Zeta Energy 20 Ah cell.
- Figure 195. Zoolnasm batteries.

I would like to order

Product name: The Global Advanced Li-ion and Beyond Lithium Batteries Market 2025-2035

Product link: <https://marketpublishers.com/r/G3F36F22B55FEN.html>

Price: US\$ 1,600.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer Service:

info@marketpublishers.com

Payment

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <https://marketpublishers.com/r/G3F36F22B55FEN.html>