

# Lithium Batteries: Markets and Materials

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## Abstracts

### SCOPE OF REPORT:

This report begins with a discussion of primary and secondary lithium battery technologies and markets.

Lithium markets and technology are analyzed associated with the following product categories

Portable products

Computing, smartphones, tablets.

Others.

Wearables (Non-Medical Related/Portable) – Consumer segment only.

Medical products

Implantable.

Not implantable.

Wearables (Medical Related) – Consumer segment only.

Stationary applications

Computer memory preservation.

Uninterruptible power supplies.

Load leveling and alternative energy storage.

Residential energy storage.

#### Military/aerospace

Primary batteries.

Secondary batteries.

Developmental.

#### Automotive and motive power

Industrial electric vehicles (traction).

Plug-ins and hybrid vehicle motive power (EVs, HEVs and BEVs).

Automotive security.

Fleet operations (primarily electric buses).

The report focuses on these areas associated with battery materials:

#### Electrode materials and active elements

Aluminum.

Cobalt compounds.

Conductive polymers.

Copper compounds.

Electrolytic manganese dioxide.

Halogens.

Fullerenes.

Inorganic carbon.

Lithium metal and compounds.

Nickel metal and compounds.

Rare earth compounds.

Sulfur compounds.

Vanadium compounds.

Lithium battery electrolytes.

Battery separators.

Market segments are defined, leading global companies are identified, and the markets analyzed (including a five-year market projection). Additional chapters provide projection breakdowns by end-use sector, application and region. Chapter 8 provides a broad overview of patent activity and developments, while Chapter 9 provides an overview of market segmentation, a concise overview of key driving factors influencing markets, and additional forecasts associated with individual products.

Lithium battery companies are identified and profiled. Each profile includes points of contact and a discussion of structure, description and activity. These profiles are found in Chapter 10.

## **REPORT INCLUDES:**

87 data tables and 66 additional tables

A detailed overview and an industry analysis of the lithium batteries in terms of markets and materials

Analyses of global market trends, with data from 2017, 2018, and projections compound annual growth rates (CAGRs) through 2023

Characterization and quantification of market potential for lithium batteries by major types of batteries, technologies, regions, applications and end-users

Details pertaining to continuing evolution of electrification of transportation, the increasing use of energy storage systems both institutionally (electric utilities) and within the household (residential) sector, and the impact of innovations in wearable technologies on this market

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Primary Lithium Battery Companies  
DURACELL INTERNATIONAL



EAGLEPICHER CORP. (OM GROUP)  
ENERGIZER HOLDINGS INC.  
GP BATTERIES (GOLD PEAK INTERNATIONAL)  
GREATBATCH INC.  
ICCNEXERGY  
MEDTRONIC INC.  
MINMAX ENERGY TECHNOLOGY  
PANASONIC ENERGY CORP. OF AMERICA  
SAFT  
SONY ENERGY DEVICES CORP.)  
ULTRALIFE BATTERIES INC.  
VARTA AG MICROBATTERIES  
YARDNEY (OM GROUP)  
Secondary Lithium Battery Companies  
A123 SYSTEMS  
ACCUTRONICS LTD.  
ADVANCED LITHIUM ELECTROCHEMISTRY CO. LTD. (ALEES)  
ADVANCED BATTERY SYSTEMS INC.  
AMPRIUS  
APPLE INC.  
AROTECH CORP.  
BASF BATTERY MATERIALS  
BATTERY-BIZ  
BATTERY CLINIC INC.  
BATTERY SYSTEMS INC.  
BATTERY TECHNOLOGY INC.  
BOLLORE GROUP  
BOSTON-POWER  
BREN-TRONICS INC.  
BRIGHTVOLT  
BYD CO. LTD.  
C&D TECHNOLOGIES INC.  
CELL-CON  
CHINA BAK BATTERY INC.  
CHINA SUN (DALIAN XINYANG HIGH-TECH DEVELOPMENT CO.)  
CONTINENTAL CORP.  
DELTRAN BATTERY TENDER  
DENCHI POWER LTD.  
ELECTROVAYA

ENERDEL  
ENERIZE CORP.  
ENERSYS INC.  
EVEREXCEED CORP.  
FARASIS ENERGY  
FLUX POWER HOLDINGS INC.  
FURUKAWA BATTERY CO.  
GENERAL MOTORS  
GP BATTERIES (GOLD PEAK INTERNATIONAL)  
GS YUASA.  
HITACHI MAXELL CORP.  
HIGHPOWER INTERNATIONAL  
HYB BATTERY CO. LTD.  
ILIKA TECHNOLOGIES LTD.  
INDUSTRIAL BATTERY ENGINEERING  
JOHNSON CONTROLS  
JOHNSON MATTHEY BATTERY SYSTEMS (AXEON)  
K2 ENERGY  
LG CHEMICAL  
MICROVAST POWER SYSTEMS LTD.  
MILLIBATT INC.  
MINING CORP. OF BOLIVIA (COMIBOL)  
MINMAX ENERGY TECHNOLOGY CO. LTD.  
MITSUBISHI CORP.  
NEC ENERGY DEVICES LTD.  
NEXCELL BATTERY CO.  
NISSAN MOTOR CO.  
ODYNE SYSTEMS LLC  
OXIS ENERGY LTD. U.K.  
PANASONIC  
POLYPLUS BATTERY CO.  
POWER JAPAN PLUS  
PRIMEARTH EV ENERGY  
SAFT  
SAMSUNG SDI  
SEEO  
SILATRONIX INC.  
SION POWER  
SOLIDENERGY

SONY ENERGY DEVICES CORP.  
TESLA MOTORS  
TIAX LLC  
TIANJIN LISHEN BATTERY JOINT-STOCK CO. LTD.  
TOSHIBA  
VALENCE TECHNOLOGY INC.  
WINSTON BATTERY LTD.  
XALT ENERGY LLC  
YARDNEY (OM)  
ZAF ENERGY SYSTEMS  
ZINERGY UK  
Electrode Material and Active Element Companies  
3M  
ABERDEEN INTERNATIONAL INC.  
ACHESON COLLOIDS INC. (HENKEL)  
ACTA S.P.A.  
ADMIRALTY RESOURCES  
AJAY SQM GROUP  
AKZO NOBEL  
ALBEMARLE CORP.  
ALFA AESAR (JOHNSON MATTHEY)  
ALLAN CHEMICAL CORP.  
ALLCHEM INDUSTRIES INC.  
ALTAIR NANOTECHNOLOGIES INC.  
AMETEK  
AMSYN (AMBER SYNTHETICS)  
APPLIED NANOMATERIALS INC.  
ARKEMA  
ASBURY CARBONS  
ASHLAND CHEMICALS  
ASHBURTON VENTURES INC.  
AVALON RARE METALS  
AVCARB  
BARIUM & CHEMICALS INC.  
BASF CORP.  
CABOT CORP.  
CALEDONIA MINING CORP.  
CANADA LITHIUM CORP.  
CANNON-MUSKEGON CORP. (C-M GROUP)

CELGARD LLC  
CHAMBISHI METALS PLC (ZCCM-IH)  
CLIMAX MOLYBDENUM  
COLUMBUS CHEMICAL INDUSTRIES  
CONTEMPORARY AMPEREX TECHNOLOGY LTD. (CATL)  
COVALENT ASSOCIATES INC.  
COYNE CHEMICAL  
CTT  
DAIS ANALYTIC CORP.  
DARAMIC  
DARTON COMMODITIES LTD.  
DEXMET CORP.  
DYNATEC MADAGASCAR S.A.  
ENTEK MEMBRANES LLC  
ERAMET/EUROTUNGSTENE POWDRES S.A.  
EVONIK INDUSTRIES AG  
ENEVATE  
EUROPEAN LITHIUM  
EVRAZ STRATCOR INC.  
FERRO CORP.  
FMC CORP.  
FORMATION METALS INC.  
FRONTIER CARBON CORP.  
FUSITE  
GALAXY RESOURCES  
GFS CHEMICALS INC.  
GLENCORE XSTRATA  
GRAFTECH INTERNATIONAL LTD.  
HENKEL  
HERMETIC SEAL TECHNOLOGY INC.  
HOLLINGSWORTH AND VOSE CO.  
HONJO CHEMICAL CORP.  
HUNAN XIANGTAN ELECTROCHEMICAL GROUP  
INNOVIA  
INTERNATIONAL COBALT CO. INC.  
INTERNATIONAL LITHIUM CORP. (GANFENG LITHIUM CO.)  
JOHNSON MATTHEY INC.  
JUNGFER  
LAMART CORP.

LITHIUM CORP.  
LITHIUM EXPLORATION GROUP  
LITHIUM WERKS  
LG CHEMICAL  
LYNNTECH INC.  
MPHASE TECHNOLOGIES  
MATERIALS AND ELECTROCHEMICAL RESEARCH CORP.  
MAXPOWER INC.  
MAYS CHEMICAL CO.  
MCGEAN SPECIALTY CHEMICALS/MCGEAN ROHCO  
MITSUI & CO., LTD.  
NANO-C INC.  
NANOCYL S.A.  
NEMASKA LITHIUM  
NEPTCO  
NIPPON KODOSHI CORP. (NKK)  
NORILSK NICKEL  
OM GROUP INC.  
PHOSTECH LITHIUM  
POREX TECHNOLOGIES  
PPG SILICA PRODUCTS  
PRAYON  
PRED MATERIALS INTERNATIONAL INC.  
PRINCE MINERALS INC.  
QUEENSLAND NICKEL  
RAYMOR INDUSTRIES INC.  
READE ADVANCED MATERIALS  
RETRIEV TECHNOLOGIES INC.  
ROCK TECH LITHIUM  
SHALINA RESOURCES LTD.  
SHELDAHL TECHNICAL MATERIALS  
SHEPHERD CHEMICAL CO.  
SHOWA DENKO K.K.  
SHU POWDERS LTD.  
SICHUAN LITHIUM INDUSTRIES  
SK ENERGY CORP.  
SOLVAY PERFORMANCE CHEMICALS  
SPECTRUM CHEMICALS  
SQM (SOCIEDAD QUIMICA Y MINERA)

SUMITOMO METAL MINING CO. LTD.  
SUPERIOR GRAPHITE CO.  
TECHNICAL FIBRE PRODUCTS LTD.  
TECK RESOURCES LTD.  
TEXMAC INC.  
THOMAS SWAN & CO. LTD.  
TIAX  
TIMCAL GRAPHITE & CARBON  
TORAY  
TRONOX INC.  
UBE INDUSTRIES  
UMICORE  
UNIDYM  
VALE CANADA  
WESTERN LITHIUM  
W. L. GORE & ASSOCIATES, INC.  
WOGEN RESOURCES LTD.  
XIAMEN TUNGSTEN CO. LTD.

## **CHAPTER 11 APPENDIX: ACADEMIC AND PUBLIC SECTOR R&D INSTITUTIONS**

A\*STAR INSTITUTE OF MATERIALS RESEARCH  
AMES NATIONAL LABORATORY  
ARGONNE NATIONAL LABORATORY  
ARIZONA STATE UNIVERSITY  
BATTELLE MEMORIAL INSTITUTE  
BROOKHAVEN NATIONAL LABORATORY  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
CALIFORNIA NANOSYSTEMS INSTITUTE (UCLA)  
CENTER FOR ADVANCED MATERIALS  
CLEAN ENERGY GROUP  
ECOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE  
FLORIDA STATE UNIVERSITY  
FLUID MECHANICS RESEARCH GROUP  
GEORGIA INSTITUTE OF TECHNOLOGY  
HUNTER COLLEGE  
IDAHO NATIONAL LABORATORY  
JOHN H. GLENN RESEARCH CENTER  
JOHN HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY

KYOTO UNIVERSITY  
KYUSHU UNIVERSITY  
LABORATOIRE D'ELECTROCHIMIE ORGANIQUE ET DE PHOTOCHEMIE R?DOX  
LAWRENCE BERKELEY NATIONAL LABORATORY  
LAWRENCE LIVERMORE NATIONAL LABORATORY  
LOS ALAMOS NATIONAL LABORATORY  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
MAX PLANCK INSTITUT F?R FESTKORPERFORSCHUNG  
MICHIGAN STATE UNIVERSITY  
NASA AMES RESEARCH CENTER  
NASA JET PROPULSION LAB  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)  
NATIONAL RENEWABLE ENERGY LABORATORY  
NORTH CAROLINA STATE UNIVERSITY  
NORTHWESTERN UNIVERSITY  
NYU POLYTECHNIC SCHOOL OF ENGINEERING  
OAK RIDGE NATIONAL LABORATORY  
OHIO STATE UNIVERSITY  
OREGON STATE UNIVERSITY  
PACIFIC NORTHWEST NATIONAL LABORATORY  
PRINCETON UNIVERSITY  
PURDUE UNIVERSITY  
BIRCK NANOTECHNOLOGY CENTER  
RENSSELAER POLYTECHNIC INSTITUTE (RPI)  
RICE UNIVERSITY  
THE RICHARD E. SMALLEY INSTITUTE FOR NANOSCALE SCIENCE AND  
TECHNOLOGY  
ROCHESTER INSTITUTE OF TECHNOLOGY  
RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY  
SANDIA NATIONAL LABORATORIES  
SAVANNAH RIVER NATIONAL LABORATORY  
SIMON FRASER UNIVERSITY  
SOPHIA UNIVERSITY  
STANFORD UNIVERSITY  
STATE UNIVERSITY OF NEW YORK (SUNY)  
UNIVERSIT? LA SAPIENZA  
UNIVERSIT?T T?BINGEN INSTITUT F?R ORGANISCHE CHEMIE  
UNIVERSITY OF CALIFORNIA  
UNIVERSITY OF CHICAGO

UNIVERSITY OF COLORADO  
UNIVERSITY OF DAYTON RESEARCH INSTITUTE  
UNIVERSITY OF DURHAM  
UNIVERSITY OF ILLINOIS  
UNIVERSITY OF KENTUCKY  
UNIVERSITY OF MASSACHUSETTS  
UNIVERSITY OF MINNESOTA  
UNIVERSITY OF MISSOURI  
UNIVERSITY OF NEVADA AT LAS VEGAS  
UNIVERSITY OF NEW MEXICO  
UNIVERSITY OF NEW SOUTH WALES  
UNIVERSITY OF NORTH CAROLINA  
UNIVERSITY OF OKLAHOMA CARBON NANOTUBES TECHNOLOGY CENTER  
(CANTEC)  
UNIVERSITY OF PENNSYLVANIA  
UNIVERSITY OF RHODE ISLAND  
UNIVERSITY OF SOUTHERN CALIFORNIA  
UNIVERSITY OF ST. ANDREWS  
UNIVERSITY OF TEXAS AT AUSTIN  
UNIVERSITY OF TOKYO  
USCAR  
VIRGINIA COMMONWEALTH UNIVERSITY  
WASEDA UNIVERSITY



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