World Battery Materials

Industry Study with Forecasts for 2019 & 2024

Study #3350 | December 2015 | $6200 | 389 pages
Table of Contents

EXECUTIVE SUMMARY

MARKET ENVIRONMENT

General ................................................. 4
World Economic Overview .................. 5
Recent Historical Trends .................... 6
World Economic Outlook .................... 7
World Population Overview ................ 10
World Manufacturing Outlook .......... 12
World Gross Fixed Investment Outlook 15
World Motor Vehicle Outlook .......... 17
Motor Vehicles In Use ....................... 17
Motor Vehicle Production Trends ...... 20
Hybrid & Electric Vehicle Outlook ... 24
Hybrid Vehicles ................................ 26
Electric Vehicles ............................... 28
Battery Industry Overview ............... 28
Primary Battery Production ............. 31
Secondary Battery Production .......... 33
Battery Materials Technology Trends 36
Conventional Battery Chemistries .... 38
Alkaline ............................................ 39
Zinc-Carbon .................................... 39
Lead-Acid ........................................ 40
Nickel-Cadmium ............................... 42
Other ............................................. 43
Advanced Battery Chemistries ....... 43
Primary Lithium ............................... 44
Rechargeable Lithium ..................... 45
Nickel-Metal Hydride ....................... 47
Zinc-Air ......................................... 48
Sodium-Metal Halide ....................... 48
Other ............................................. 49
Battery Materials Pricing Patterns .... 50
Environmental & Regulatory Issues .. 52
Recycling ....................................... 52
Health & Safety .............................. 54

WORLD BATTERY MATERIALS OVERVIEW

General ............................................. 56
Demand by Region ......................... 57
Demand by Product ......................... 60
Metals ........................................... 63
Lead ............................................ 65
Steel ............................................ 67
Zinc ............................................. 68

NORTH AMERICA

Economic Overview ......................... 104
Battery Materials Demand ............. 107
United States ............................... 110
Canada ........................................ 118
Mexico ......................................... 125

WESTERN EUROPE

Economic Overview ......................... 133
Battery Materials Demand .......... 136
Germany ...................................... 139
Spain .......................................... 146
Italy ............................................ 153
France ......................................... 160
United Kingdom ......................... 167
Other Western Europe ............. 174
Belgium ....................................... 182
All Other Western Europe ...... 182

ASIA/PACIFIC

Economic Overview ......................... 184
Battery Materials Demand .......... 187
China ........................................ 190
Japan ........................................ 199

South Korea .................................. 207
India .......................................... 215
Indonesia .................................... 222
Taiwan ........................................ 229
Other Asia/Pacific .................... 236
Thailand ..................................... 244
Malaysia .................................... 245
Singapore .................................. 245
All Other Asia/Pacific .............. 246

OTHER REGIONS

Central & South America ............... 248
Economic Overview .................... 248
Battery Materials Demand .......... 251
Brazil ........................................ 253
Other Central & South America .... 260
Eastern Europe ......................... 267
Economic Overview .................... 267
Battery Materials Demand .......... 270
Russia ........................................ 272
Other Eastern Europe ............ 279
Poland ....................................... 287
Czech Republic ......................... 287
All Other Eastern Europe ....... 288
Africa/Mideast ......................... 289
Economic Overview .................... 289
Battery Materials Demand .......... 292

INDUSTRY STRUCTURE

General ........................................... 296
Market Share .............................. 299
Lead Products ......................... 300
Other Battery Materials .............. 303
Manufacturing ............................ 306
Cooperative Agreements .......... 308
Marketing & Distribution ......... 312
Acquisitions & Divestitures ...... 313

COMPANY PROFILES

Albemarle Corporation .................... 316
Altair Nanotechnologies .............. 318
AMETEK Incorporated .................. 319
Anyang Yubei Gold & Lead ......... 320
Arkema SA ................................. 321
BASF SE .................................... 323
Cabot Corporation ...................... 326
Celanese Corporation ................. 329

(continued on following page)
List of Tables/Charts

EXECUTIVE SUMMARY

1 Summary Table .....................................................3

MARKET ENVIRONMENT

1 World Gross Domestic Product by Region..................10
2 World Population by Region.................................12
3 World Manufacturing Value
   Added by Region.............................................14
4 World Fixed Capital Investment by Region..............16
5 World Motor Vehicles in Use
   by Type & Region...........................................19
6 World Motor Vehicle Production
   by Type & Region............................................23
7 World Hybrid & Electric Vehicle
   Production by Type & Region............................26
8 World Battery Shipments by Region......................31
9 World Primary Battery
   Shipments by Region........................................33
10 World Secondary Battery
    Shipments by Region .......................................35
11 World Battery Shipments
    by Type, 2004-2024.......................................36
12 Basic Battery Construction.................................38

WORLD BATTERY MATERIALS OVERVIEW

1 World Battery Materials
   Demand by Region...........................................59
2 World Battery Materials
   Demand by Product.........................................62
3 World Battery Metals Demand
   by Product & Region.........................................64
4 World Demand for Lead in Batteries......................66
5 World Demand for Steel in Batteries.....................68
6 World Demand for Zinc Metal in Batteries..............69
7 World Battery Chemicals Demand
   by Product & Region.........................................73
8 World Battery Chemicals Demand
   by Type & Region...........................................74
9 World Demand for Lead
   Chemicals in Batteries....................................77
10 World Demand for Manganese
    Chemicals in Batteries...................................81
11 World Demand for Other Materials in
   Batteries by Product & Region............................83
12 World Battery Materials Demand
   by Battery Type.............................................88
13 World Primary Battery Materials
    Demand by Chemistry & Region..........................90
14 World Secondary Battery Materials
    Demand by Chemistry & Region............................97
15 World Secondary Battery Materials
    Demand by Chemistry, 2004-2024.......................98

NORTH AMERICA

1 North America: Key Indicators for Battery Materials Demand...........107
2 North America: Battery Materials Demand by Type & Application........109
3 United States: Key Indicators for Battery Materials Demand..............110
4 United States: Battery Materials Demand by Type..........................113
5 United States: Battery Materials Demand by Application.................116
6 Canada: Key Indicators for Battery Materials Demand.....................118
7 Canada: Battery Materials Demand by Type................................121
8 Canada: Battery Materials Demand by Application........................123
9 Mexico: Key Indicators for Battery Materials Demand........................125
10 Mexico: Battery Materials Demand by Type................................128

(continued on following page)
List of Tables/Charts
(continued from previous page)

10 Mexico: Battery Materials Demand by Type.........................130
11 Mexico: Battery Materials Demand by Application ...............132

WESTERN EUROPE
1 Western Europe: Key Indicators for Battery Materials Demand 136
2 Western Europe: Battery Materials Demand by Type & Application 138
Cht Western Europe: Battery Materials Demand by Country, 2014........139
3 Germany: Key Indicators for Battery Materials Demand ...........142
4 Germany: Battery Materials Demand by Type.......................144
5 Germany: Battery Materials Demand by Application .............146
6 Spain: Key Indicators for Battery Materials Demand .............149
7 Spain: Battery Materials Demand by Type...........................151
8 Spain: Battery Materials Demand by Application .................153
9 Italy: Key Indicators for Battery Materials Demand ...............156
10 Italy: Battery Materials Demand by Type & Application ........158
11 Italy: Battery Materials Demand by Application .................160
12 France: Key Indicators for Battery Materials Demand ..........163
13 France: Battery Materials Demand by Type.........................165
14 France: Battery Materials Demand by Application ...............167
15 United Kingdom: Key Indicators for Battery Materials Demand 170
16 United Kingdom: Battery Materials Demand by Type...............172
17 United Kingdom: Battery Materials Demand by Application ....174
18 Other Western Europe: Key Indicators for Battery Materials Demand 177
19 Other Western Europe: Battery Materials Demand by Type........179
20 Other Western Europe: Battery Materials Demand by Application & Country 181

ASIA/PACIFIC
1 Asia/Pacific: Key Indicators for Battery Materials Demand ..........186
2 Asia/Pacific: Battery Materials Demand by Type & Application ..189
Cht Asia/Pacific: Battery Materials Demand by Country, 2014 .........190
3 China: Key Indicators for Battery Materials Demand ..............193
4 China: Battery Materials Demand by Type............................197
5 China: Battery Materials Demand by Application ..................199
6 Japan: Key Indicators for Battery Materials Demand ..............202
7 Japan: Battery Materials Demand by Type............................205
8 Japan: Battery Materials Demand by Application ..................207
9 South Korea: Key Indicators for Battery Materials Demand ........210
10 South Korea: Battery Materials Demand by Type..................212
11 South Korea: Battery Materials Demand by Application ........214
12 India: Key Indicators for Battery Materials Demand ..............217
13 India: Battery Materials Demand by Type............................220
14 India: Battery Materials Demand by Application ..................222
15 Indonesia: Key Indicators for Battery Materials Demand .........225
16 Indonesia: Battery Materials Demand by Type.....................227
17 Indonesia: Battery Materials Demand by Application ............229
18 Taiwan: Key Indicators for Battery Materials Demand ..........232
19 Taiwan: Battery Materials Demand by Type........................234
20 Taiwan: Battery Materials Demand by Application ...............236
21 Other Asia/Pacific: Key Indicators for Battery Materials Demand 239
22 Other Asia/Pacific: Battery Materials Demand by Type ............241
23 Other Asia/Pacific: Battery Materials Demand by Application & Country 244

OTHER REGIONS
1 Central & South America: Key Indicators for Battery Materials Demand ....250
2 Central & South America: Battery Materials Demand by Type & Application ....253
3 Brazil: Key Indicators for Battery Materials Demand ..............256
4 Brazil: Battery Materials Demand by Type............................258
5 Brazil: Battery Materials Demand by Application ..................260
6 Other Central & South America: Key Indicators for Battery Materials Demand ....262
7 Other Central & South America: Battery Materials Demand by Type ........265
8 Other Central & South America: Battery Materials Demand by Application ....267
9 Eastern Europe: Key Indicators for Battery Materials Demand ..........270
10 Eastern Europe: Battery Materials Demand by Type & Application ..........272
11 Russia: Key Indicators for Battery Materials Demand ..............275
12 Russia: Battery Materials Demand by Type............................277
13 Russia: Battery Materials Demand by Application ..................279
14 Other Eastern Europe: Key Indicators for Battery Materials Demand ..........282
15 Other Eastern Europe: Battery Materials Demand by Type ............284
16 Other Eastern Europe: Battery Materials Demand by Application & Country ......286
17 Africa/Mideast: Key Indicators for Battery Materials Demand ..........291
18 Africa/Mideast: Battery Materials Demand by Type & Application ..........295

INDUSTRY STRUCTURE
1 Battery Materials Sales by Company, 2014 .........................298
Cht World Lead Battery Materials Market Share, 2014 .............301
Cht World Non-Lead Battery Materials Market Share, 2014 ......304
2 Selected Cooperative Agreements .................................309
3 Selected Acquisitions & Divestitures .................................314
World Battery Materials
Industry Study with Forecasts for 2019 & 2024

Growth in demand will be driven by rapidly expanding production of advanced battery types in response to growing output of portable electronics, hybrid and electric vehicles (H/EVs), and energy storage products.

World demand to rise 8.3% annually through 2019

Global demand for battery materials is forecast to rise 8.3 percent per year to $46.8 billion in 2019. Rapidly expanding production of advanced battery types -- including lithium-ion (Li-Ion) and nickel-metal hydride (Ni-MH) batteries -- will be an important driver of demand in response to growing output of portable electronics, hybrid and electric vehicles (H/EVs), and energy storage products. The continued importance of lead-acid batteries in the automotive sector will also support healthy gains in materials demand. Improving levels of disposable income and global spending will favor demand for materials used in better performing primary batteries, including alkaline and primary lithium types.

Chemicals to be fastest growing battery materials

Demand for metals used in battery production will show healthy gains worldwide, driven primarily by lead, which is used exclusively in lead-acid batteries. Although conventional motor vehicle production has slowed in more developed regions, growing output of motor vehicles in developing economies will support gains. Nickel metal will also post gains, as global production of Ni-MH batteries increases to meet growing demand for industrial applications. As consumers turn toward better performing primary battery types, consumption of zinc-carbon batteries will slow, restraining gains for zinc and steel.

The chemical segment will experience the fastest gains, with the strongest growth posted by lithium and nickel chemicals, driven by increasing production of Li-Ion and Ni-MH batteries worldwide. In addition, continued growth in demand for alkaline batteries in developing countries, as well as increasing production of Li-Ion batteries, will support gains in demand for manganese dioxide, while growing production of lead-acid batteries will drive demand for sulfuric acid. Other battery materials such as widely used carbon and graphite products will also post healthy gains, while increases in lead-acid battery production will support demand for plastics used in the battery cases, as well as polymers and glass used as separators.

China to remain largest national market

China will remain the largest national market for battery materials, as domestic battery production continues to grow at a double-digit rates. Growth in demand will be restrained by an economic slowdown, but China will still post the fastest gains of all major global markets. India is also forecast to post above-average gains in battery materials demand, as battery production ramps up to meet growing domestic demand and increasing motor vehicle production and use in the country. Overall, the Asia/Pacific region will post the fastest gains of any region, driven in part by its dominance in advanced secondary battery production.

Copyright 2015 The Freedonia Group, Inc.
Sample Text, Table & Chart

ASIA/PACIFIC

China: Battery Materials by Type

In 2014, demand for battery materials reached $12.0 billion in China, with metals accounting for 67 percent of total demand. Demand for metals grew more than 11 percent yearly from 2009 to 2014, significantly slower than the previous five year period. The slowdown was primarily due to a decrease in demand for lead as the production of this battery type slowed and metal prices were stable from the volatility seen between 2004 and 2009. Other metals -- such as zinc, nickel, and lithium -- all posted stronger growth, supported by double-digit increases in specialized battery types such as Li-Ion and nickel-based batteries. Increased production of lithium- and nickel-based battery types also supported double-digit growth in demand for chemicals and other materials during the 2009-2014 period.

Demand for battery materials in China is forecast to increase nearly 11 percent per year to $20.1 billion in 2019. Although growth will continue to decelerate from the stellar rate recorded during the 2004-2009 period, gains will still outpace every other major battery materials market in the world by a wide margin. Advances will be fueled by increases in the production of virtually all battery types, including lead-acid, lithium-, and nickel-based products. As a result, some growth is expected in the Chinese market for nearly all types of battery materials, with lithium, lead chemicals, polymers, and other materials like silica all recording double-digit gains through 2019. Limiting gains to some extent will be a continued stabilization of prices for most battery materials. Demand for lead production from the highs of the 2004-2009 period, and the nearly 28 percent annual growth in Chinese materials during this period was reflective of skyrocketing metal and chemical prices.

Metals were the largest battery materials market in China and demand for lead metal is forecast to post annual gains of 11 percent per year through 2019. China has risen to become the largest...
Tata Steel Limited
Bombay House
24 Homi Mody Street
Fort, Mumbai
India
91-22-6665-8282
http://www.tatasteel.com

Sales: $22.8 billion (FY 2015)

Geographic Sales:  (FY 2015, as percent of total) India 32%, Other Asian Countries 11%, Europe 52%, and Other Countries 5%

Employment: 79,650 (FY 2015)

Key Products: nickel-plated cold-rolled steel strip

Tata Steel is India’s largest steel producer. The Company also manufactures ferroalloys, minerals, bearings, agricultural and other equipment, tubes, wire, aluminum, and other products. Tata Steel is part of Tata Group (India), a holding entity for more than 90 companies.

Tata Steel was the third leading supplier of non-lead products to the world battery materials market in 2014. The Company is involved in the world battery materials industry through the Tata Steel Europe Limited subsidiary (United Kingdom), which generated FY 2015 sales of $5.4 billion. Tata Steel Europe’s products include high-strength metal strip for battery, automotive, sporting ammunition, household appliance, and electrical applications. For battery end uses, the company makes HILUMIN electrolytically nickel-plated cold-rolled steel strip. HILUMIN steel strip features corrosion resistance, leak protection, reliable adherence of the nickel layer, enhanced deep drawing properties, tight gauge and surface tolerances, and efficient processing for high volume production. This steel strip can be used to make battery...
Order Information

Five Convenient Ways to Order

ONLINE: www.freedoniagroup.com
MAIL: Print out and complete the order form and send to The Freedonia Group (see address at the bottom of this form)
PHONE: Call toll free, 800.927.5900 (US) or +1 440.684.9600
FAX: +1 440.646.0484 (US)
EMAIL: info@freedoniagroup.com

Free Handling & Shipping
There is NO charge for handling or UPS shipping in the US. Expect delivery in 3 to 5 business days. Outside the US, Freedonia provides free airmail service. Express delivery is available at cost.

Orders Outside of the US
Checks must be made payable in US funds, drawn against a US bank and mailed directly to The Freedonia Group. For wire transfers please contact our customer service department at info@freedoniagroup.com. Credit cards accepted.

Credit Card Orders
For convenience, Freedonia accepts American Express, MasterCard or Visa. Credit card purchases must include account number, expiration date and authorized signature.

Save 15%
If you order three (3) different titles at the same time, you can receive a 15% discount. If your order is accompanied by a check or wire transfer, you may take a 5% cash discount (discounts do not apply to Corporate Use Licenses).

Corporate Use License
Now every decision maker in your organization can act on the key intelligence found in all Freedonia studies. For an additional $2600, companies receive unlimited use of an electronic version (PDF) of the study. Place it on your intranet, email it to coworkers around the world, or print it as many times as you like.

Click here to learn more about the Corporate Use License

Order Form

World Battery Materials .................................................... $6200

☐ Corporate Use License (add to study price) * $2600
☐ Additional Print Copies @ $600 each

Total (including selected option) $ ____________________________

☐ Enclosed is my check (5% discount) drawn on a US bank and payable to The Freedonia Group, Inc., in US funds (Ohio residents add 8% sales tax)

☐ Bill my company ☐ American Express ☐ MasterCard ☐ Visa

Credit Card # ____________________________ Expires mm/yy Security Code __________

Signature ________________________________________________

* Please check appropriate option and sign below to order an electronic version of the study.

☐ Individual Use License Agreement
The undersigned hereby represents that the above captioned study will be used by only ___ individual(s) who are employees of the company and that the study will not be loaded on a network for multiple users. In the event that usage of the study changes, the Company will promptly notify Freedonia of such change and will pay to Freedonia the appropriate fee based on Freedonia’s standard fee schedule then in effect. Note: Entire company corporate use license, add $2600; one additional user, add $600; two additional users, add $1200; three additional users, add $1800.

Signature ________________________________________________

☐ Corporate Use License Agreement
The above captioned study may be stored on the company’s intranet or shared directory, available to company employees. Copies of the study may be made, but the undersigned represents that distribution of the study will be limited to employees of the company.

Signature ________________________________________________

The Freedonia Group, Inc. • 767 Beta Drive • Cleveland, OH • 44143-2326 • USA • Website: www.freedoniagroup.com
Tel US: 800.927.5900 or +1 440.684.9600 • Fax: +1 440.646.0484 • Email: info@freedoniagroup.com
Related Studies

**World Lithium**
Global demand for lithium metal is projected to rise 8.9 percent per year through 2019 to 49,350 metric tons. Gains will be driven by demand for lithium-ion (Li-ion) batteries as world demand for hybrid and electric vehicles, energy storage systems, and high-drain portable electronics continues to grow. This study analyzes the 32,200 metric ton world lithium industry, with forecasts for 2019 and 2024 by product and market for six world regions and 19 major countries. The study also evaluates company market share and profiles industry players.
#3337  September 2015  $6300

**World Batteries**
Global battery demand is forecast to rise 7.8 percent per year to $120 billion in 2019. China will remain the largest national market as well as one of the fastest growing. Secondary batteries will outpace primary types. Rechargeable lithium-ion batteries will be the fastest growing products. This study analyzes the $83 billion world battery industry, with forecasts for 2019 and 2024 by type and market for six world regions and 16 countries. The study also reviews battery technology, evaluates company market share and profiles industry participants.
#3309  July 2015  $6700

**World Graphite (Natural, Synthetic & Carbon Fiber)**
World demand for natural and synthetic graphite (including carbon fiber) is forecast to expand 5.8 percent annually to 4.2 million metric tons in 2018, valued at $30 billion. China will remain the largest and fastest growing market. Synthetic graphite will continue as the largest volume segment, while carbon fiber will grow the fastest. This study analyzes the 3.2 million metric ton world graphite industry, with forecasts for 2018 and 2023 by type, market, world region, and for 16 countries. The study also evaluates company market share and profiles industry players.
#3164  August 2014  $6100

**World Fuel Cells**
Global demand for commercial fuel cells will almost triple to $4 billion in 2017 and then triple again by 2022 to $12 billion. Motor vehicle, portable electronics, and industrial stationary/motive power applications will grow the fastest. Japan and the US will remain by far the largest markets, while China and South Korea will grow the fastest. This study analyzes the $1.5 billion world fuel cell industry, with forecasts for 2017 and 2022 by product, chemistry, application, world region, and for 16 countries. The study also evaluates company market share and profiles industry players.
#3140  April 2014  $6300

**Battery & Fuel Cell Materials**
US demand for battery and fuel cell materials is expected to grow 4.3 percent annually through 2017 to $6.1 billion. Polymers, metals and other materials will lead gains. Material usage in secondary batteries will outpace primary batteries, while fuel cells will be the fastest growing application overall from a small base. This study analyzes the $4.9 billion US battery and fuel cell material industry, with forecasts for 2017 and 2022 by type, function and application. The study also evaluates company market share and profiles industry players.
#3115  January 2014  $5100

About The Freedonia Group

The Freedonia Group, Inc., is a leading international industry market research company that provides its clients with information and analysis needed to make informed strategic decisions for their businesses. Studies help clients identify business opportunities, develop strategies, make investment decisions and evaluate opportunities and threats. Freedonia research is designed to deliver unbiased views and reliable outlooks to assist clients in making the right decisions. Freedonia capitalizes on the resources of its proprietary in-house research team of experienced economists, professional analysts, industry researchers and editorial groups. Freedonia covers a diverse group of industries throughout the United States and other world markets. Industries analyzed by Freedonia include:

- Automotive & Transport
- Chemicals
- Construction & Building Products
- Consumer Goods
- Energy & Petroleum
- Industrial Components
- Healthcare & Life Sciences
- Machinery & Equipment
- Metals, Minerals & Glass
- Packaging
- Plastics & Other Polymers
- Security
- Services
- Textiles & Nonwovens
- Water Treatment

Freedonia Custom Research

Freedonia Custom Research delivers the same high quality, thorough and unbiased assessment of an industry or market as an industry study. Since the research initiative is based upon a company’s specific needs, companies harness Freedonia’s research capabilities and resources to answer unique questions. When you leverage the results of a Freedonia Custom Research engagement, you are able to obtain important answers to specific questions and issues associated with: mergers and acquisitions, new product launches/development, geographic expansion, entry into new markets, strategic business planning, and investment and funding decisions.

Freedonia Custom Research is ideal for companies seeking to make a strategic difference in the status quo and focus on future business growth. Working side by side with clients, Freedonia’s team is able to define a research project that is custom-tailed to answer specific questions and provide the basis from which a company can make informed business decisions.