Global Market for Lithium-Ion Batteries - Forecast, Trends & Opportunities 2014-2020

Table of Contents

1. EXECUTIVE SUMMARY

Key Takeaways

The global market for lithium ion batteries is a fast growing one and is expected to cross $30 billion by 2020. It continues to advance as high power and high capacity cells increase penetration into large-format applications. Vying for market adoption, the lithium-ion chemistry competes heavily with established energy storage technologies, such as lead acid, in many of these applications. However, key performance characteristics have enabled lithium-ion to increase market penetration, resulting in growth opportunities.

Currently most lithium-ion batteries are used in consumer electronic devices like mobile phones and notebook PCs. However, moving forward expansion is likely for automotive products used in Electric Vehicles and in storage applications.

Lithium-ion batteries for storage have come into the spotlight due to the electricity supply issues resulting from the eastern Japan earthquake and the global efforts to embrace smart grids. With domestic and overseas lithium-ion battery makers entering the markets for storage systems, the market for lithium-ion batteries for storage is beginning to take off. However, currently the storage market is in its infancy, so market growth will take time.

TDK Corporation, Samsung SDI Co. Ltd., LG, Panasonic, Hitachi, are some the biggest players in the industry. In recent years in the consumer electronics market, South Korean firms have been aggressively winning market share thanks to the weak won and impressive cost competitiveness. In contrast, Japanese and Chinese firms have struggled. With the market getting more competitive, a succession of Japanese firms in particular has been pushing production shifts to China.

Report Coverage

Taiyou Research presents an analysis of the Global Market for Lithium-Ion Batteries. The report covers the following:

- An understanding of what lithium-ion batteries are is included to set the stage for understanding the importance of such advanced batteries in the global battery market. We analyze the structure of lithium-ion batteries, the materials used such as cathode materials, anode materials, separators, amongst others. Manufacturing processes and performance analysis as compared with other storage types is also included.

- An analysis of the global Lithium-Ion Battery market includes an industry overview, analysis of the supply-demand scenario, industry segmentation by automotive lithium-ion batteries, storage batteries, and lithium-ion batteries used in consumer electronics. A look at the industry structure and trends in technology completes this section.

- An analysis of the major battery materials used such as cathode and anode materials, electrolytic solutions and separators is included. We also analyze the market share of the various players involved in the production of battery materials.

- An analysis of the key markets where lithium-ion batteries are making waves namely China, Japan, South Korea, and the United States. For each market, we analyze the industry through the various industry segments as well.

- A look at the various growth factors and industry barriers includes an analysis of the declining profit margins of the lithium-ion battery industry, the growth potential of the automotive lithium-ion battery segment and the storage battery segment, amongst other factors. The rise of the Chinese battery market is analyzed in the factors as well.

- Market forecast for the global lithium-ion battery industry includes an overall industry forecast, a segment-wise forecast, a forecast for China's battery market, and an overall forecast for the major players in the industry.

- Companies such as Panasonic, Hitachi, Mitsubishi Chemical, Samsung, LG Chem, and others are analyzed through product profiles, company strategies, market outlook, investment risk analysis, company trends, financials, and a SWOT analysis.

Research Methodology

Taiyou Research's team of researchers and analysts use a variety of research sources for making a report. Most of the data – information and statistics – for our products is gathered using the secondary research by our in-house team of researchers. The main objective of Taiyou Research's secondary research exercise is to exhaust all sources of published information including websites of government agencies, consumer and trade associations, annual reports and accounts of companies, news articles from well-known publications and online databases like Factiva, OneSource, Thomson, Hoovers, etc.

The data thus gathered is send to our team of analysts who verify that data and look for research gaps. These gaps are filled through primary research, that is, our analysts gain information from various agencies, associations and companies using customer surveys, telephonic and email interviews, etc. Finally, all the information collected using secondary and primary research is analyzed and synthesized by our analysts and is presented in a report.

Industry information and data for this report has been sourced through numerous channels including publically available information from companies' and industry association websites. For industry sizing, segmentation and trends, apart from desk research, we have contacted industry experts and executives from various companies.

Market forecasts are done using statistical forecasting techniques based on historic performance. Statistical tools are further supplemented with qualitative parameters like industry expectation, economic drivers, new product development, customer surveys, ongoing research, etc.

All the information gathered was then analyzed and synthesized by our in-house team of analysts.

2. TECHNOLOGICAL KNOW-HOW

What are Lithium-Ion Batteries?

A lithium-ion battery is an electric device capable of charging and discharging. They are widely used as a power supply for consumer electronics as well as hybrid and electric vehicles. Semiconductors and LCDs control electronic circuits and display information; lithium-ion batteries supply the electrical energy they need to perform these functions.

A Li-B is comprised of positive (cathode) and negative (anode) electrode materials divided by a separator, and electrolytic solution (Figure 9). The positive electrode is a lithium compound and the negative electrode a carbon material. A binder is used to attach them to a current collector (copper foil or aluminum foil). The positive and negative electrode materials and the separator are rolled inside a metal case together with the electrolytic solution.

A lithium-ion battery discharges/charges by way of a chemical reaction between the positive and negative electrode materials in the cell. During discharge, a chemical reaction extracts lithium ions from the negative electrode, which flow through the separator and insert in the positive electrode. Through this process, electrons are carried from the negative electrode to the positive electrode, creating a current that is discharged via an external circuit. During charging, voltage is applied to the battery via an external circuit, causing lithium ions to flow in the reverse direction, from the positive electrode to the negative electrode.

Structures of Lithium-Ion Batteries

Figure 1: Basic Structure of a Lithium-Ion Battery

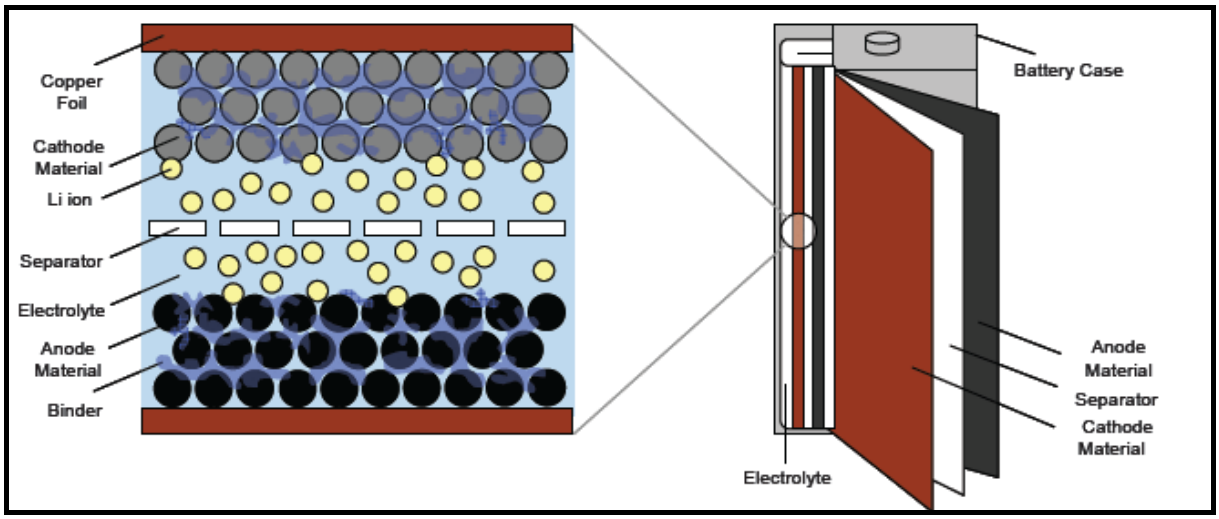
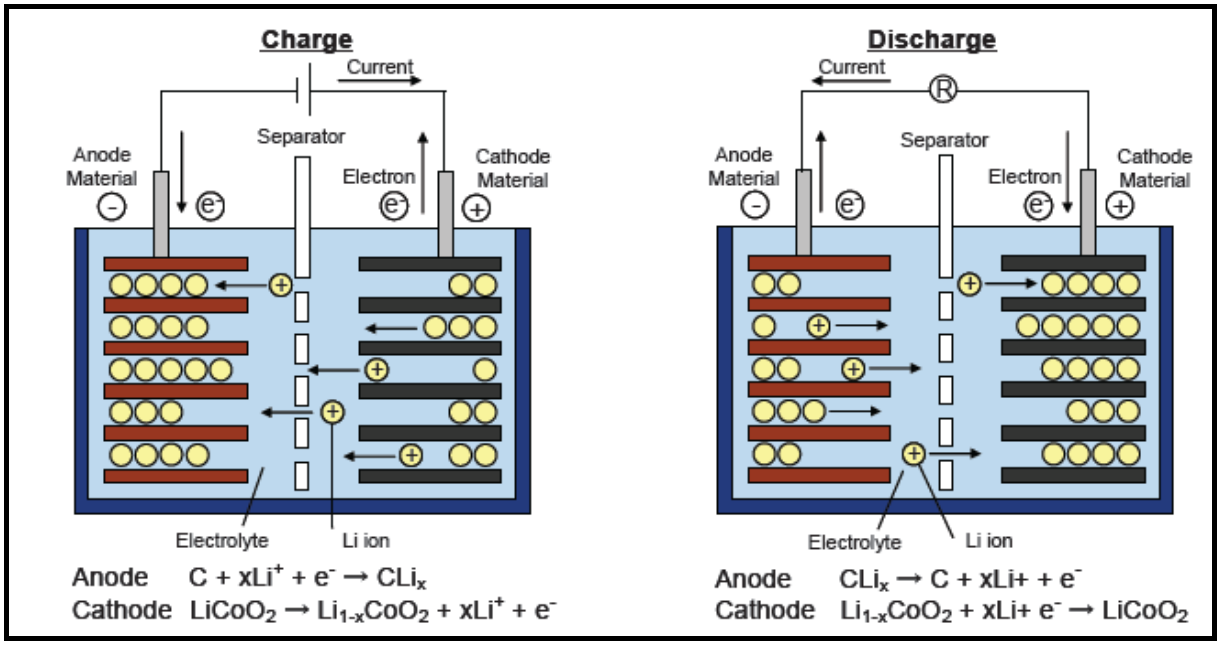


Figure 2: Lithium-Ion Battery Basic Working Theory

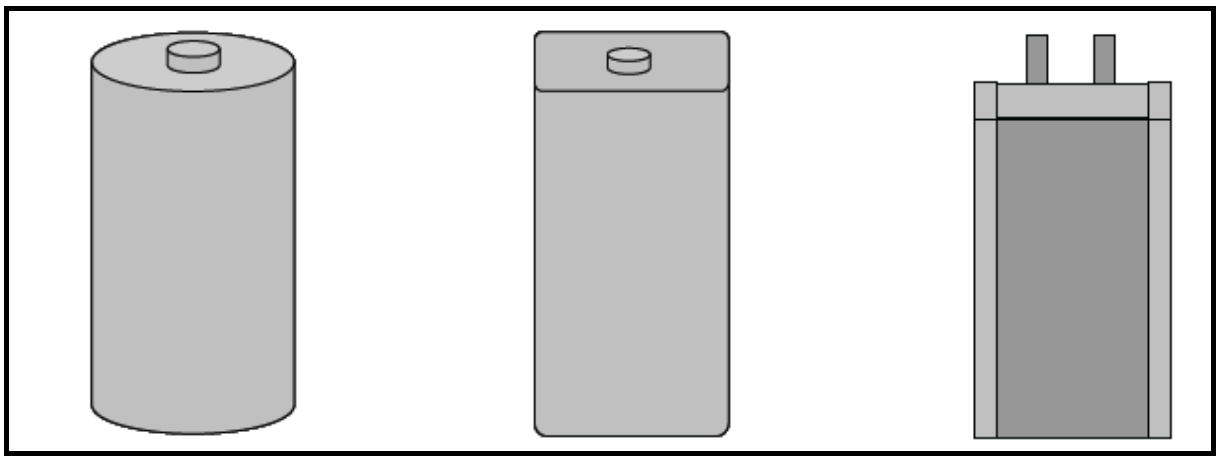


Lithium-ion batteries are made in three shapes: cylindrical, prismatic, and laminate. Cylindrical lithium-ion batteries are often used in notebook PCs, while prismatic and laminate lithium-ion batteries are mainly used in mobile phones that require thin and compact power sources. Medium and large lithium-ion batteries used for electric vehicle and power storage applications come in all three shapes. Cylindrical lithium-ion batteries have steel cases and are characterized by superior structural strength and large capacity potential. Also, because of the ease of rolling the battery components, this shape is suitable for mass production and helps to keep costs low. Cylindrical lithium-ion batteries are often used in notebook PCs, which require high-capacity, low-cost batteries.

Prismatic lithium-ion batteries have an aluminum case and their profile is more easily lowered compared with cylindrical lithium-ion batteries. Also, when a battery contains multiple cells, the prismatic shape allows for more efficient use of space compared with a cylinder, which has dead space. Prismatic lithium-ion batteries are used in mobile phones that require thin and compact power sources.

Unlike cylindrical and prismatic lithium-ion batteries, which have metal cases, laminate lithium-ion batteries are wrapped in an aluminum laminate film similar to the retort packaging used for instant foods. Laminate lithium-ion batteries often use a gel electrolyte, in which case they are usually called lithium polymer batteries. Laminate lithium-ion batteries are lighter than cylindrical and prismatic lithium-ion batteries and more flexible in design. For these reasons they are increasingly being adopted for smartphones and tablet PCs. They are also being adopted for electric vehicles because of their superior safety performance.

Figure 3: Shapes of Lithium-Ion Batteries



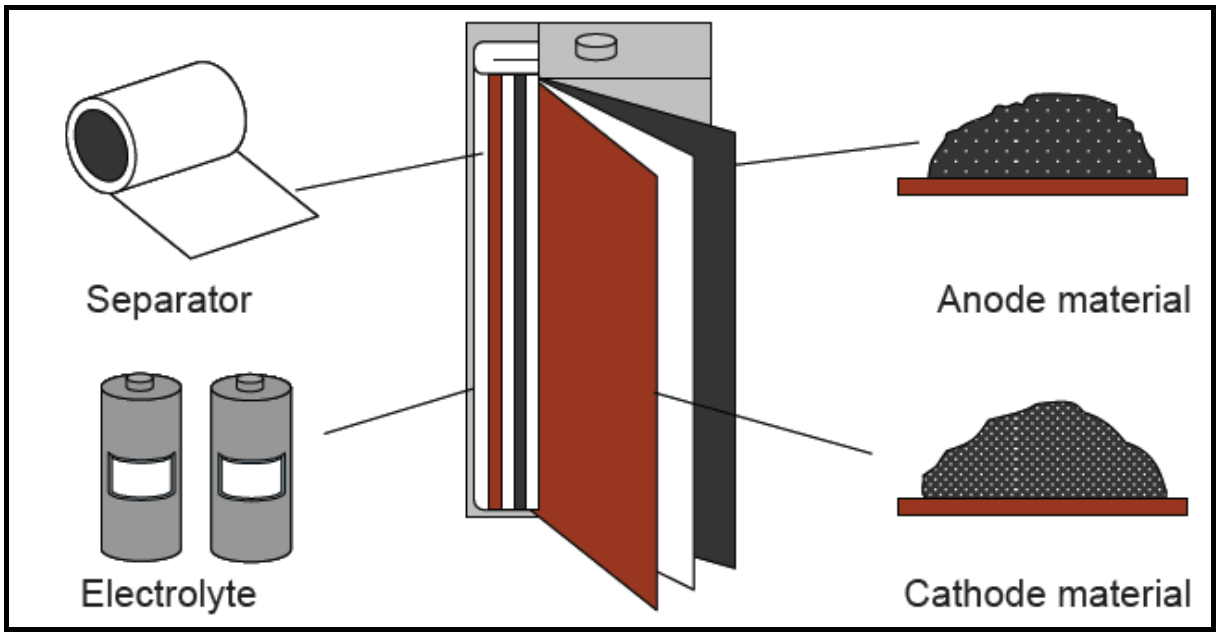
Materials Used in Lithium-Ion Batteries

The performance of lithium-ion batteries depends heavily on the materials from which they are made. As the operation of rechargeable batteries is based on chemical reactions, performance is directly affected by the materials. In addition, because there is a risk that lithium-ion batteries can combust, materials play an important role in securing safe performance.

The four main materials used in lithium-ion batteries are cathode materials, anode materials, separators, and electrolytic solution. Cathode and anode materials supply lithium ions when batteries are discharging/charging. A separator is a film with many small holes that provide a passageway for lithium ions between positive and negative electrodes during discharge/charging. The electrolytic solution is an organic solvent diffused with electrolytes, which carry lithium ions between electrodes.

The relationship between materials and lithium-ion battery performance is as follows: 1) the difference between the oxidation reduction potential of positive and negative electrodes becomes the operating voltage, which means that the operating voltage of a lithium-ion battery is determined by the combination of cathode and anode materials; 2) power density and energy density is determined by the type of cathode and anode materials; 3) safety is determined by the type of cathode material and the performance of the anode materials and electrolytic solution; 4) life span is determined by the anode materials and electrolytic solution. Also, the type of cathode material is related to battery life span in terms of performance degradation.

Figure 4: Major Materials for Lithium-Ion Batteries



3. GLOBAL MARKET FOR LITHIUM-ION BATTERIES

Industry Value by Revenues

Lithium-based batteries are the most popular advanced batteries for use in portable consumer electronics, and Battery Electric Vehicles (BEVs). However, they were not the first choice for use in Hybrid Electric Vehicles (HEVs) for several years spanning the initial stages of the EV market due to the high cost associated with this battery type compared to its nickel-based counterpart. With the fall in prices of lithium-based batteries after 2005, HEV batteries, auto manufacturers have started using lithium batteries in HEVs increasing its market size significantly.

The following figure shows the market size of lithium based batteries for the 2008–2013 period and the expected market size for the 2014–2020 forecast period.

Figure 5: Revenues of the Global Lithium-based Battery Market (in USD Billion), 2008-2020

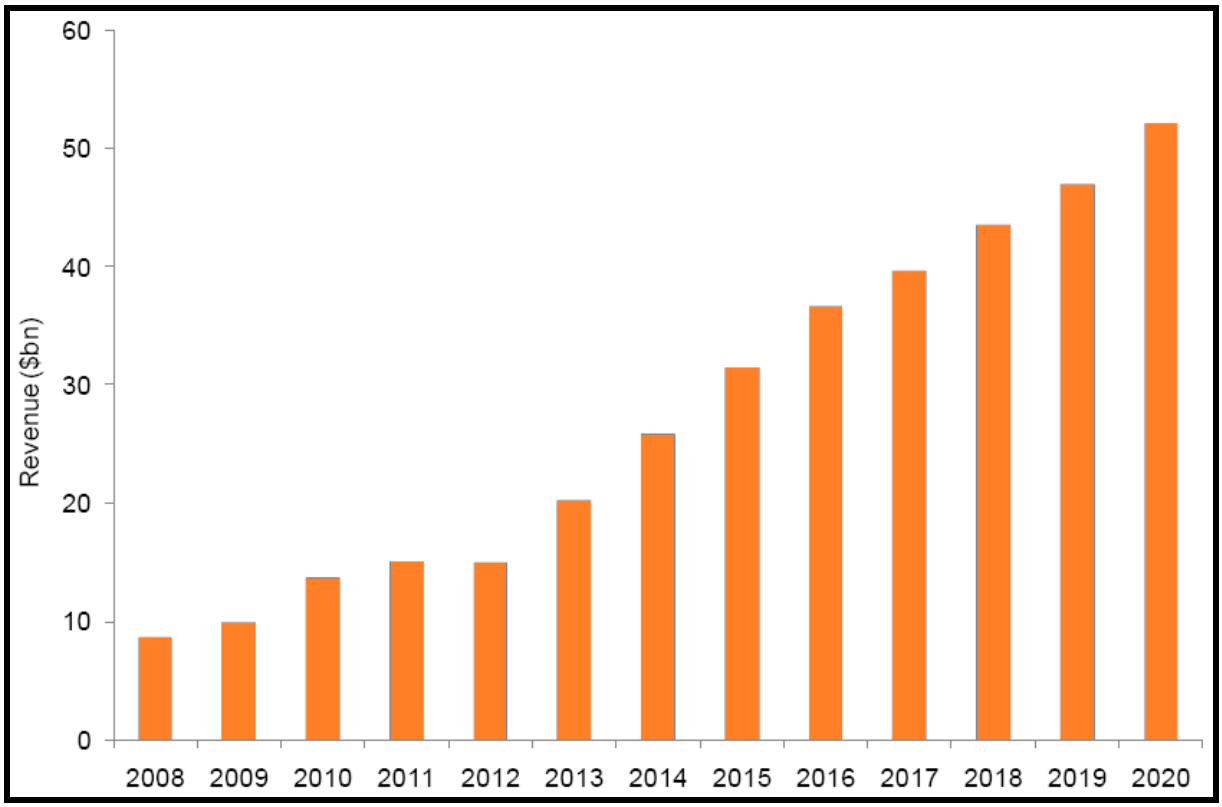


Table 1: Revenues of the Global Lithium-based Battery Market (in USD Billion), 2008-2020

Year	Revenues (in USD Billion)
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	
2016	
2017	
2018	
2019	
2020	

4. GLOBAL MARKET FOR BATTERY MATERIALS

Industry Overview

Many firms in Japan, South Korea, China, and the US have entered the lithium-ion battery market and it presents a crowded and chaotic picture. Among the Japanese players are Panasonic, Sony, TDK, Hitachi, NEC, Toshiba, GS Yuasa, and Mitsubishi Electric. South Korean firms include Samsung SDI and LG Chem, while the Chinese are represented by BYD, Tianjin Lishen Battery, and BAK and the US by A123.

In lithium-ion batteries, the areas and products in which companies have their forte are different and the markets have been growing distinct to a degree. In consumer electronics, the Japanese players are Panasonic, Sony, TDK, and Hitachi, while South Korean firms include Samsung SDI and LG Chem and Chinese ones BYD, Tianjin Lishen Battery, and BAK. In autos, the Japanese players are Panasonic, Hitachi, NEC, Toshiba, and GS Yuasa, which are lined up against LG Chem and SB LiMotive from South Korea, BYD from China, and A123 from the US.

In consumer electronics, Panasonic, Samsung SDI, and LG Chem are the top makers and they are developing their operations on all fronts. This trio ships a variety of cylindrical, prismatic, and laminate batteries for a wide range of applications. Many of the other firms are more specialized, with TDK focusing on laminate batteries and Hitachi Maxell on prismatic ones, as they bid to differentiate themselves as niche players.

In recent years in the consumer electronics market, South Korean firms have been aggressively winning market share thanks to the weak won and impressive cost competitiveness. In contrast, Japanese and Chinese firms have struggled. With the market getting more competitive, a succession of Japanese firms in particular has been pushing production shifts to China. The Big 3 of Panasonic, Samsung SDI, and LG Chem have a combined market share of over 60% and the market is increasingly becoming an oligopoly.

In the automotive market, the Japanese firms of Panasonic, Hitachi, Toshiba, NEC, and GS Yuasa, and the overseas firms of LG Chem, SB LiMotive, BYD, A123, and JCI are aggressively pushing commercialization. Currently the Japanese makers seem to be in the lead technologically but with the automotive market still in its technological infancy, many firms are pouring efforts into automotive batteries and international competition is growing more intense.

Figure 6: Sales of Lithium-Ion Batteries at Panasonic, Samsung SDI, and LG Chem

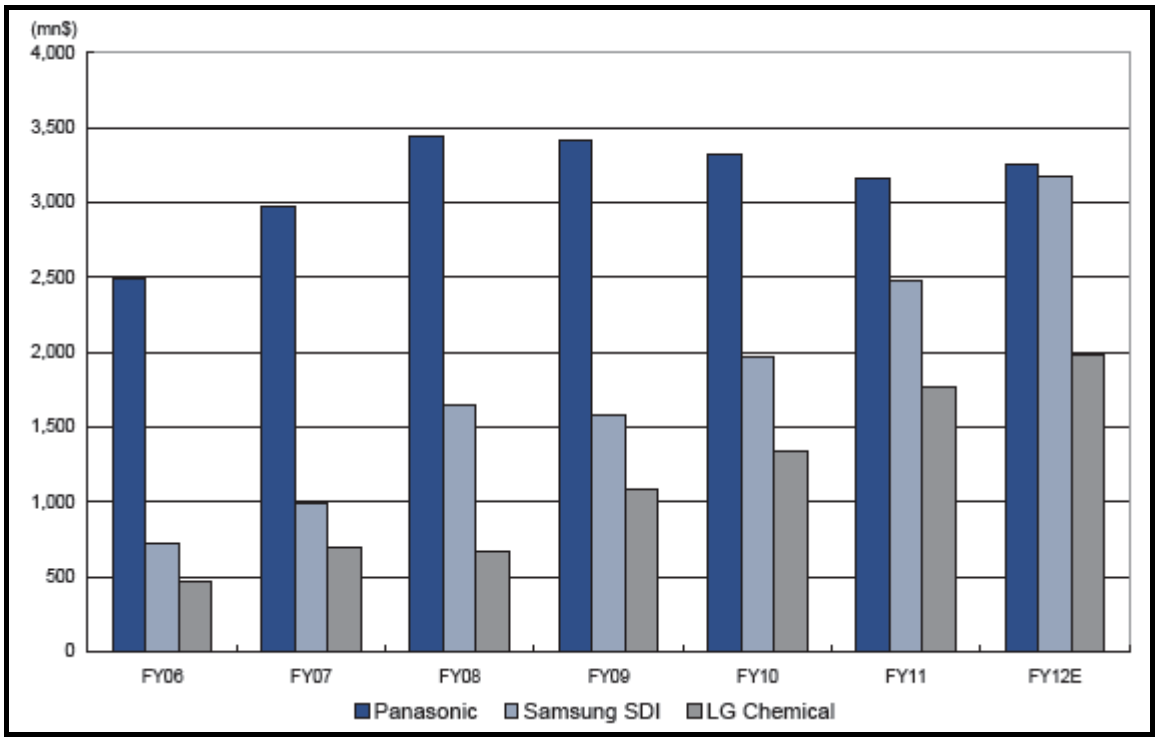
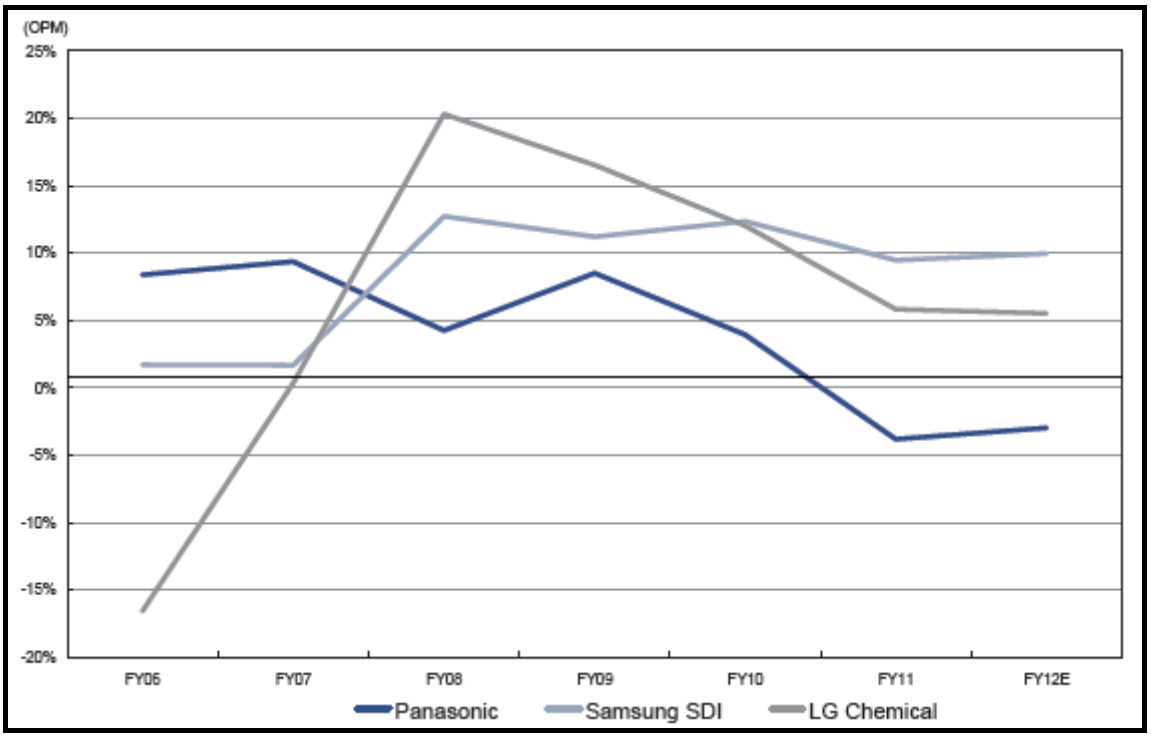


Figure 7: Sales Margins of Lithium-Ion Batteries at Panasonic, Samsung SDI, and LG Chem



5. GLOBAL LITHIUM-ION BATTERY INDUSTRY ANALYSIS OF KEY MARKETS

China

The main sources of demand for local Chinese battery makers are 1) "white-box" electrical goods, as typified by knock-off mobile phones and also including notebook PCs, mobile phones, and tablet PCs, 2) battery packs in the aftermarket that are not from the device manufacturer, 3) local Chinese automakers, especially low-speed EVs and electric motorcycles, and 4) local Chinese storage battery makers. Local Chinese battery makers include BYD, BAK, Lishen, and other majors, as well as firms such as HYB, B&K, DLG, Harbin Coslight, and AEEnergy.

The local Chinese battery market is a gray one, and no accurate statistics exist on the size of the market. However, given the battery material consumption volumes and the unit battery price at the low-end (c$0.30/Wh-$0.40/Wh), we put the market on a cell basis at around $5bn in 2013. We think the local Chinese market will basically continue to grow, as we expect the Chinese economy to continue to grow and it is the state policy of the Chinese government to foster the battery industry.

We think that the local Chinese battery makers operate in a market that is basically independent of the global lithium-ion battery market, as it is a low-end field which Japanese and South Korean firms do not target and the major sources of demand, such as makers of "white-box" goods, are in the gray zone. However, since the local Chinese market is vast, equivalent to around half of the consumer electronics market, we think there could be business opportunities for materials makers, as some of the Chinese makers are being called on to improve performance, reliability, and quality. Indeed, Ube Industries and W-Scope have won local Chinese battery makers as mainstay customers for their separators and are expanding earnings here.

Table 2: Major Lithium-ion Battery Companies in China

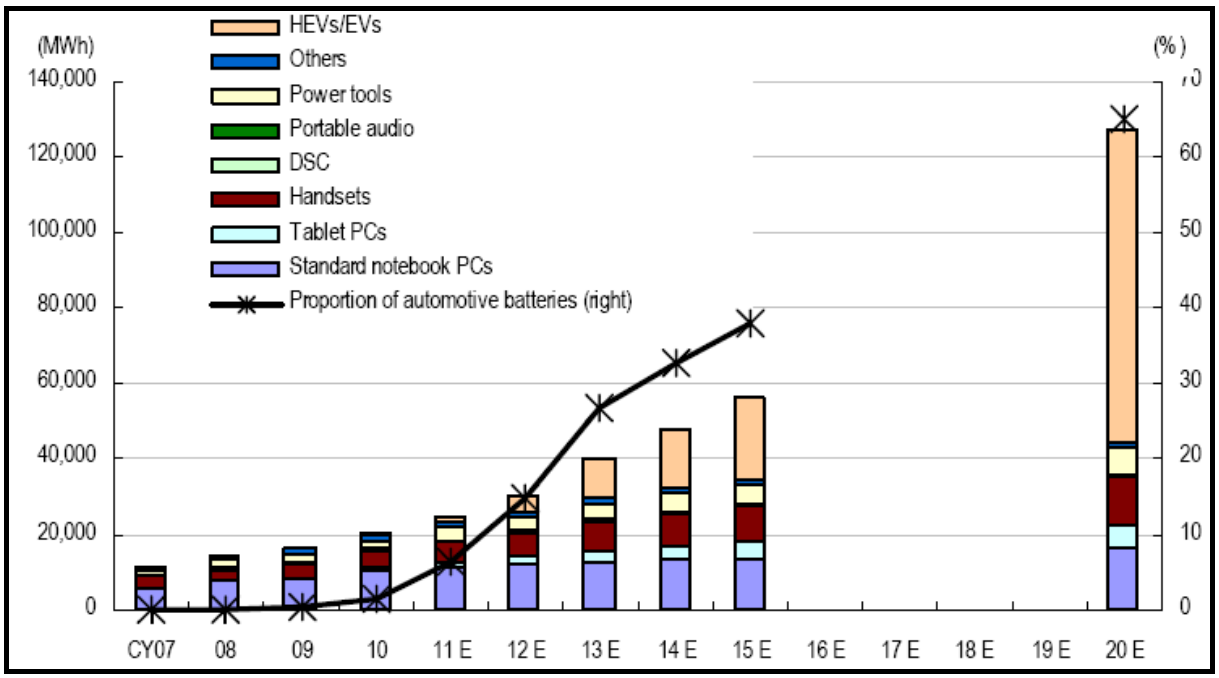
Company	URL
BYD	http://www.byd.com.cn/
BAK	http://www.bak.com.cn/
Tianjin Lishen	http://en.lishen.com.cn/
HYB	http://www.hyb-battery.com/
Harbin Coslight	http://www.cncoslight.com/
B&K	http://www.bkbattery.com/
ShenZhen WISEWOD	http://www.wisewod.com/
Ningbo Veken Battery	http://www.vekenbattery.com/
Wanxiang EV	http://www.wanxiang.com/
DLG	http://www.dlgbattery.com/
Herewin	http://www.haiyin.net/
OceanSun	http://www.osbattery.com/
AEEnergy	http://www.aeenergy.com/
CHAM	http://www.cham.com.cn/
Great Power	http://www.greatpowerhk.com/

7. GLOBAL LITHIUM-ION BATTERY MARKET FORECAST

Industry Forecast

The lithium-ion battery market was worth around $10bn in FY2011. This mainly comprised batteries for consumer electronics (mobile phones, notebook PCs, digital cameras). Moving forward, we expect market expansion to shift from consumer electronics applications to 1) auto applications, mainly hybrid vehicles (HEV), plugin hybrid vehicles (PHEV), and electric vehicles (EV), and 2) industrial applications, mainly storage batteries.

Figure 8: Li-ion Battery Demand Outlook on a Capacity Basis, 2007-2020



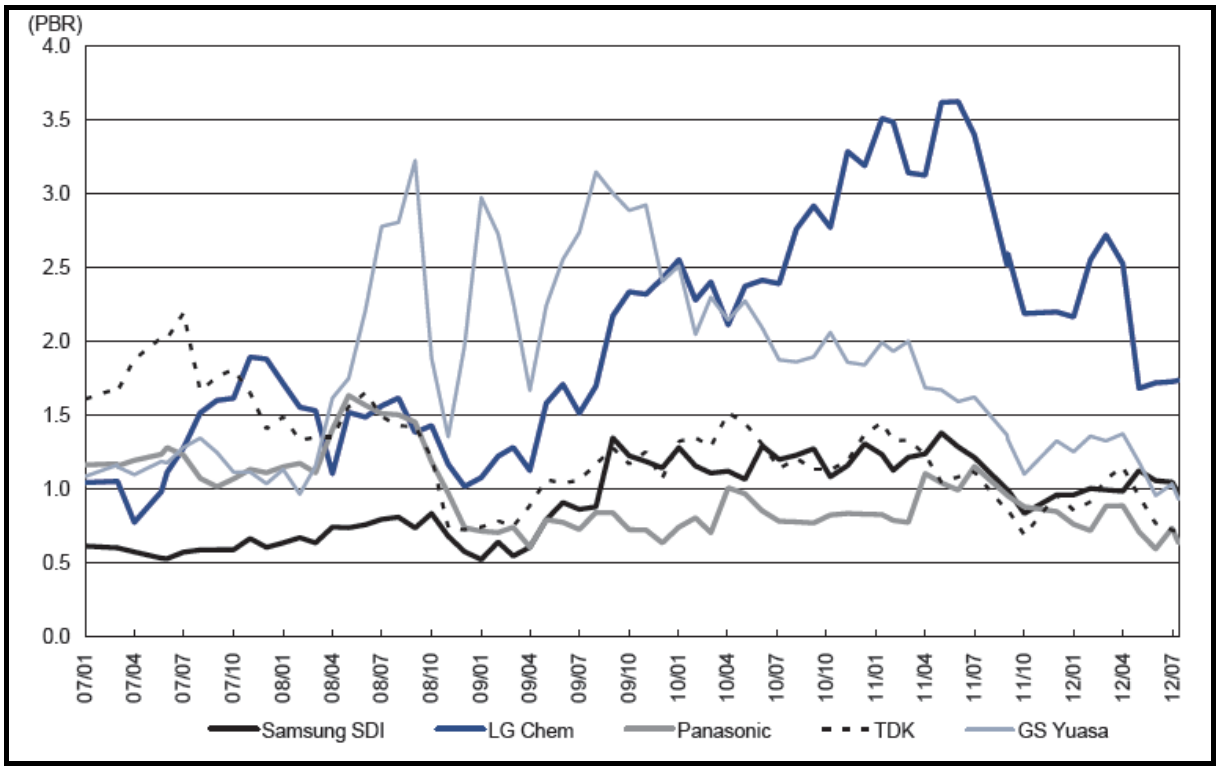
8. COMPANY PROFILES

Competition in the Industry

Panasonic was an early mover in the growth market of automotive lithium-ion batteries, and we expect expansion for this core business as part of the company's structural reforms. Lithium-ion batteries used in consumer electronics fell into the red in 2011, but we believe a return to profitability is likely longer term on sales mix improvement and cost cutting (via shifting production to China and utilization of Chinese-made materials). TDK is the top maker of laminated lithium-ion batteries, and as such is likely to benefit from increasing demand for these batteries from makers of smartphones and tablet PCs. TDK has ensured cost competitiveness by utilizing Chinese-made materials and Chinese production facilities, so we believe it should be able to maintain high margins. LG Chem is the top maker of lithium-ion batteries for use in consumer electronics and automotive applications, and we feel it is well-positioned to benefit from battery market expansion. On the other hand, although Samsung SDI is the global leader in lithium-ion batteries for consumer electronics because 1) its display business profitability is down and its solar cell business is in the red and 2) it was slow to get into the automotive battery market.

Among battery material makers, we highlight Ube Industries and Hitachi Chemical. Ube Industries produces electrolytic solutions and separators, both key battery materials. We note that it makes highly cost-competitive dry-type separators, and it has won over customers among Chinese makers of lithium-ion batteries used in consumer electronics. Ube has also put itself in a good position in terms of automotive battery materials, enabling it to benefit in the middle and low end consumer electronics-related market and from expansion for the automotive market. Hitachi Chemical is the world's top maker of negative electrode materials, and it leads the market for negative electrode materials in both consumer electronics and automotive applications. The rise of Chinese firms like BTR is a concern, but there is a gap between Hitachi Chemical and Chinese firms in terms of quality and reliability, and we also note that Hitachi Chemical plans to set up a new back-end plant in China to ensure cost competitiveness.

Figure 9: PBRs for Major Manufacturers of Lithium-Ion Batteries, 2007-2012



Asahi Kasei

Company Overview

Asahi Kasei Corporation is mainly engaged in chemical business. It has seven business segments. The Chemical segment offers petrochemicals, functional films, functional resins and synthetic rubbers, among others. The Housing segment is engaged in the development and sale of housing, as well as the renovation, real estate transaction and housing loan businesses. The Drug and Medical segment offers pharmaceuticals and medical devices, including artificial kidneys, blood purifiers, leukocyte removal filters, virus clearance filters and others. The Textile segment offers synthetic textile and nonwoven fabrics. The Electronics segment is engaged in the manufacture and sale of electronic materials and electronic components. The Construction Material segment offers aerated light-weight concrete and high-performance adiabatic materials. The Others segment is engaged in the design, construction and maintenance of industrial facilities, as well as the manpower dispatching and agency businesses.

Contact Details:

Asahi Kasei Corporation
Jinbocho-Mitsui Building
1-105, Kanda Jinbocho
Chiyoda-ku
Tokyo, 101-8101
Japan
Tel: +81 3 3507-2060
Fax: 81-3-32963161
Website: www.asahi-kasei.co.jp

Business Segments

Asahi Kasei Corporation (Asahi Kasei) provides solutions to fibers, housing, construction, chemicals, consumer products, electronics, and health care markets. Its product offerings include styrene, diagnostic reagents, polymers, acrylonitrile, nutritional products, contact lenses, medical devices and electronic products. The company operates its business through eight reportable segments, namely, Chemicals, Homes, Health Care, Fibers, Electronics, Construction Materials, Critical Care and Others.

The company's Chemicals segment offers ammonia, acrylonitrile, caustic soda, styrene, adipic acid, methyl methacrylate, synthetic resins and explosives. Its polymer products include polyacetal, acrylonitrile-butadiene-styrene and polystyrene, polyamide 66 and modified polyphenylene ether. These products find application in the manufacture of packaging products, plastic films and foams for industrial use. The segment's specialty products include foods, and personal care products; ultrapure water; ion-exchange membranes; membrane filtration systems for drinking water; and systems for chlor-alkali production; and explosives. For the fiscal year ended March 2013, the company reported revenue of ¥684,582m from the Chemicals segment, which accounted for 41.1% of the company's total revenue in 2013. The Homes segment carries out the design, supervision and contracting of homes, condominiums and apartments, condominium and apartment operation; home renovation, real estate, residential land development and urban development. It offers houses and apartments under brand names such as Hebel Haus, Atlas and Hebel Maison. For the fiscal year ended March 2013, the company reported revenue of ¥486,182m from the Homes segment, which accounted for 29.2% of the company's total revenue in 2013.

Financial Analysis

For the fiscal year ended 31 March 2014, Asahi Kasei Corp revenues increased 14% to Y1.898T. Net income applicable to common stockholders increased 89% to Y101.3B. Revenues reflect Chemical segment increase of 16% to Y791.62B, Housing segment increase of 10% to Y534.38B, Critical care segment increase of 53% to Y79.84B, Japan segment increase of 9% to Y1.289T, Other segment increase of 28% to Y421.47B.

Industry Presence

Asahi Kasei is a top maker of separators with a global share of 40% (value base). Akira Yoshino, known as the father of lithium-ion batteries, is an Asahi Kasei fellow, and it has long been involved in lithium-ion batteries and related materials. The firm has two separator plants, one in Moriyama (Shiga Prefecture) with annual capacity of 150mn m2 and one in Hyuga (Miyazaki Prefecture) with capacity of 55mn m2. Asahi Kasei is also building facilities with 50mn m2 in capacity at the Hyuga site, expected to come on-stream in 2013. Asahi Kasei's main focus is wet-type separators, but it is also developing dry-type separators for automotive applications.

It appears that separators accounted for just below 20% of sales in the electronics segment in FY3/13, and we believe margins are quite high. The segment's OP was ¥6.2bn in FY3/13, but it looks as if a number of products lost money, with separators and electronic compasses being the main money-spinners. Over the past five years, it appears sales (primarily for batteries used in consumer electronics) have risen about 8% annually, and we look for firm growth to continue moving forward. In particular, we anticipate a real surge for automotive products from FY3/14.

SWOT Analysis

Asahi Kasei provides innovative solutions based on chemistry and material science to a diverse range of markets including fibers, housing, construction, chemicals, consumer products, electronics, and health care. The company's operations in diverse fields and market leading chemical business provide it a competitive edge over its peers. Though the company has risks associated with competition and regulations, new product launches and strategic agreements could ensure higher revenue.

Strengths

Focused Research and Development: Asahi Kasei carries out research and development (R&D) activities to improve its business operations. The company carries out R&D through a network of established research and development centers and laboratories. For the fiscal year ended 2013, the company invested around JPY53.3 billion in R&D activities, as compared to JPY48.5 billion in 2012. It focuses on the development of new products in compliance with environmental norms. It also focuses on the enhancement of existing processes and products to stay up-to-date with the emerging market changes.

Currently, its R&D activities involve three main fields: environment & energy, residential living, and health care. Its core technologies include fiber spinning, membrane and filtration, biotechnology, analytical, semiconductor film manufacturing and others. Recently, as an attempt to enhance its R&D operations, it completed the construction of an integrated R&D facility, Kawasaki Innovation Center, in Kanagawa, Japan. Such focus on research and development and a broad patent portfolio enable the company to offer innovative products and solutions and maintain a competitive edge.

Weaknesses

High Debt Burden: High debt could have a major impact on the operational performance of the company as a major portion of the company's earnings would be diverted towards servicing of its debt obligations. This could concern the investors as well as make it difficult for the company to raise funds at favorable terms from the market. Asahi Kasei's total debt component stood at ¥381,438m in 2013, as compared to ¥184,114m in 2012. The company's interest payment stood at ¥3,556m in 2013, as compared to ¥2,787m in 2012. Such huge debt increases the debt servicing obligations of the company and impacts its cash flows adversely. It could limit Asahi Kasei's ability to raise debt in future and pursue other strategic opportunities. It would also increase the company's vulnerability to adverse economic and industry conditions.

Opportunities

Positive Outlook for ABS: As part of Chemicals business, the company offers a range of chemicals/derivatives and polymer products to global markets. Acrylonitrile-Butadiene-Styrene (ABS) is one of the major products of the company. It is widely used as an economical engineering plastic that incorporates chemical resistance, hardness, toughness, impact strength, gloss and other capabilities. The company provides a wide range of ABS products that are applicable in computer hardware, tool boxes, clock, video cassettes and motorcycle parts. According to industry estimates, ABS is expected to be one of three largest volume engineering plastics, accounting for more than three-quarters of total demand in 2013. The global market for ABS is estimated to grow at a CAGR of 5.6% during 2010-2020 to reach 10.9 million tons. Among the major markets, Asia Pacific, primarily China, is projected to account for more than 80% of the global ABS demand in 2020. With an extensive product line and presence in critical areas, the company could increase its sales and overall market share.

Threats

Effect of Natural Disasters: Asahi Kasei's major market base is Japan, which is prone to several natural disasters such as earthquakes, typhoons, tsunamis, and volcanic disruptions. It operates both manufacturing units and laboratories in Chiba, Shizuoka, Kanagawa, and Okayama, which have recorded high magnitude earthquakes in 2011 and 2012. The company's facilities are also vulnerable to accidents, fires, and other crises. Any major earthquake in future could lead to shutdown of or damage to the company's facilities. Such events could interrupt the company's manufacturing activities, damage equipment, disrupt access to water and electricity, and cause many other problems that could affect its business and operating results. The precautionary measures employed may not be sufficient in the event of major disasters. The company needs to spread its operations over relatively safer geographical regions to ensure uninterrupted business operations.

Disclaimer

The information in this report was prepared by Taiyou Research and Taiyou Research has used reasonable efforts in collecting, preparing and providing quality information and material, but does not warrant or guarantee the accuracy or completeness, adequacy or currency of the information contained in this report.

Users of the information do so at their own risk and should independently corroborate said information prior to any use of it. The information contained in this report is not to be construed as advice. Taiyou Research does not undertake to advise the recipient or any other reader of this report of changes in its opinions or information. This information is provided "as is" and Taiyou Research assumes no liability for and User(s) acknowledges that Taiyou Research shall have no liability for any uses, lawful or otherwise, made by User(s) of the information contained in this report.