

Biweekly 009 Dec/05

# “Aluminum Plastic Film” - New Blue Ocean of Lithium Battery Industry

Dec. 2016



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**SMM**

Shanghai Metals Market

## Improvement in Lithium Battery Properties Expands Development Room for Aluminum Plastic Film

April 7, 2016

Source: cnstock.com

1

Massive expansion of new energy vehicles will require higher safety ability for lithium battery. As pivotal material for lithium battery, aluminum plastic film is expected to be in a booming stage. Mainstream electric vehicle producers use large volume of aluminum plastic film for packaging. **The potential market size can amount to RMB 10 billion.**

Driven by upgrading of consumption electronics and expansion of new energy vehicle market, polymer lithium battery is popular due to superior performance. Polymer lithium battery now takes a small proportion in lithium power resources, but the proportion will increase substantially with technical improvement. Meanwhile, higher requirements for safety and capacity of lithium battery from new energy vehicles will also help stimulate demand for aluminum-plastic film.



## SELEN Science & Technology Acquires Lithium Battery Aluminum Plastic Film Business

April 11, 2016

Source: alu.cn

2

SELEN Science & Technology announced that it has acquired Japan-based T&T's lithium battery aluminum plastic film business for JPY 9.5 billion (RMB 550 million), on April 4, 2016. T&T, jointly founded by Toppan Printing and Toyo Seikan Kaisha and engaging in the manufacturing and selling of lithium battery packaging materials, is the third largest lithium battery aluminum plastic film supplier in the world.

The acquisition diversified SELEN Science & Technology's product portfolio which is in line with the company's strategy transformation plan. SELEN Science & Technology will thus become China's first supplier that has high-end lithium battery aluminum plastic film capacity.



## Acquisition of Japan's Aluminum-Plastic Film Producer Will Help Speed Up Localization Process

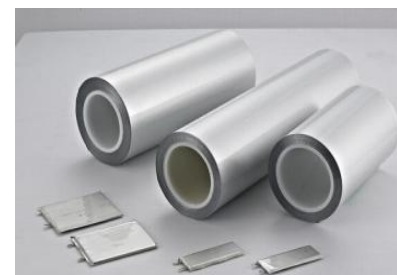
June 30, 2016

Source: gg-lb.com

3

Output value of domestic soft pack batteries hit RMB 32.5 billion in 2015, and the demand for lithium battery aluminum plastic film was 67.50 million square meters, with market size of RMB 2.12 billion, up by 23% YoY. Imported products took up over 95% aluminum plastic film products from Shodex and DNP, **while domestic products only accounted for less than 5%.**

With the accelerating pace of new energy vehicles soft-package automotive battery application, aluminum-plastic film market is expanding rapidly and domestic products can seize more opportunities to realize import substitution. At present, merely a few domestic producers are capable to produce aluminum-plastic film and their market share is very tiny. The acquisition of Japan's aluminum plastic film producer will facilitate the localization process of aluminum plastic film production, so that to break up the monopoly by Japanese and South Korean companies.



## 1 Soft-package lithium battery tends to be mainstream while aluminum plastic film is the pivotal packaging material

- Soft-package lithium battery has good security, light weight, and large capacity, in which aluminum plastic film is the pivotal packaging material.
- Output of 3C digital Soft package lithium battery is estimated to be 18.2GWh and that of automotive soft-package battery is expected to be 6.5GWh in 2016. Soft-package lithium battery will still be mainly used in 3C digital field.
- Soft-package battery tends to widely used in automotive battery market, with penetration rate expected to reach 50%.

## 2 China's aluminum plastic film is still in the introduction stage. The key performance indicators are deep drawing and corrosion resistance

- The history of producing aluminum-plastic film in China is not long. That is, China is still in the introduction stage of such industry. The shortcut to narrow the gap between domestic and overseas technology is via business merger and acquisition.
- Aluminum plastic film is mainly produced by dry-process and heat-process while that for motive power lithium battery is mainly produced by dry-process. Performance indicators of the domestic products are much lower than those made in Japan.

## 3 Global aluminum plastic film market monopolized by Japan

- Global aluminum plastic film market has been dominated by Japanese companies for a long time. The two oligopolies, Shodex and DNP, take a lion's share in global market, the proportion expected to be amount to 72% in 2016.
- China relies heavily on aluminum-plastic film imported from Japan. As estimated, about 92% of the products are imported in 2016 while the localization rate will be only 8%, which is mainly used in 3C digital field.

## 4 Aluminum plastic film gross margin reaches 50%, and localization is expected to speed up benefiting from motive soft package battery

- Demand for aluminum plastic film is vigorous and was mainly driven by 3C digital soft-package battery by the end of 2014. Since 2015, aluminum plastic film benefits from booming automotive soft-package battery market, with averaging gross margin at around 50% at present.
- By 2020, the demand for aluminum plastic film will reach 399.21 million square meters. The growth of automotive soft-package battery will directly stimulate the demand for 152 $\mu$ m aluminum plastic film. Meanwhile, aluminum plastic film localization rate is expected to accelerate and rise to 30% by 2020.

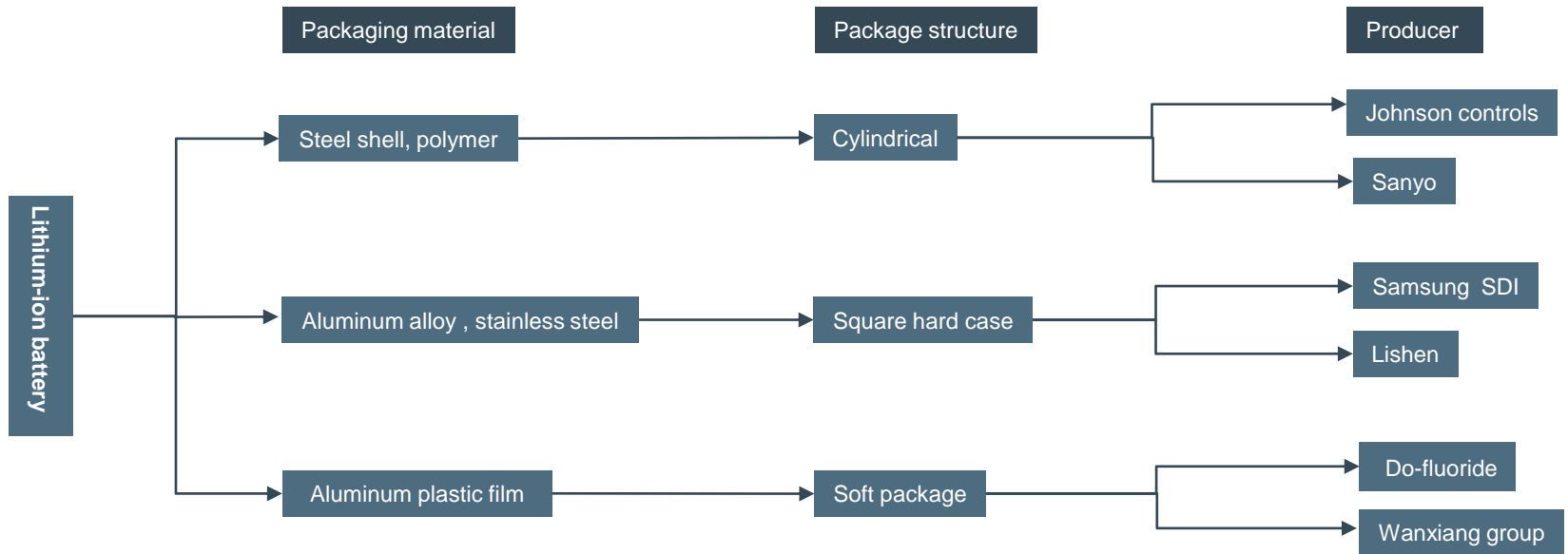
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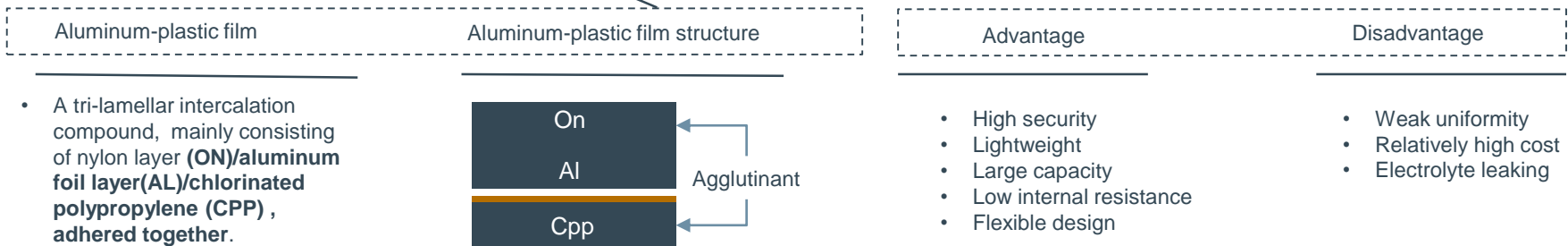
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# Aluminum plastic film: key material for soft-package lithium-ion battery encapsulation

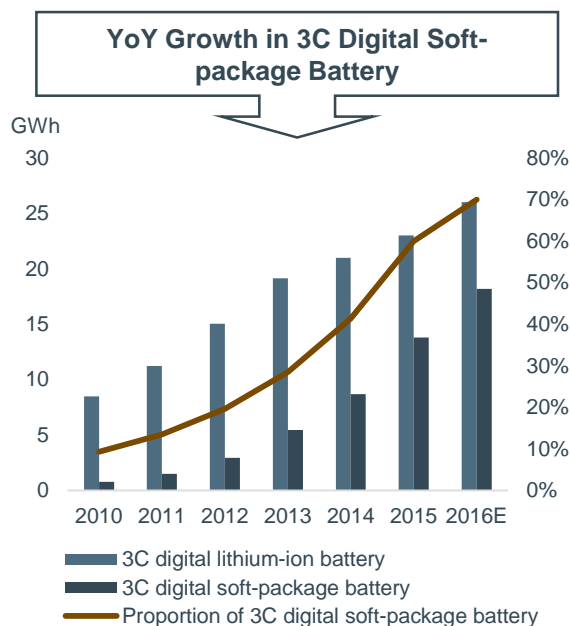
## 1. Lithium-ion battery encapsulation



## 2. Aluminum plastic foil and soft-package battery

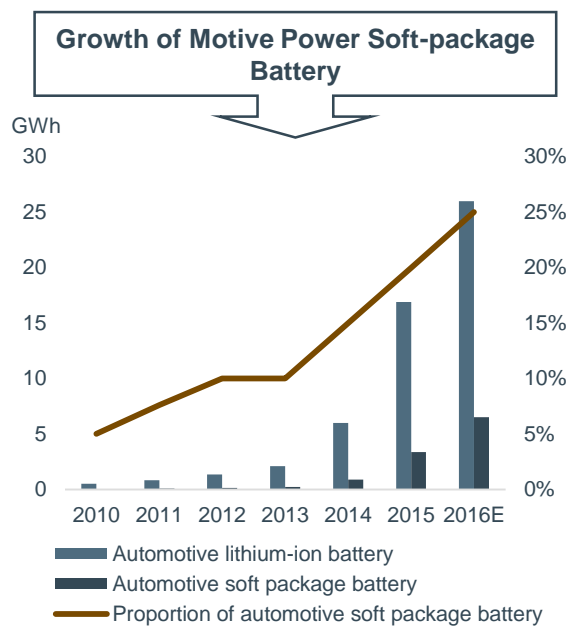


# Soft-package battery is still mainly used in 3C digital field

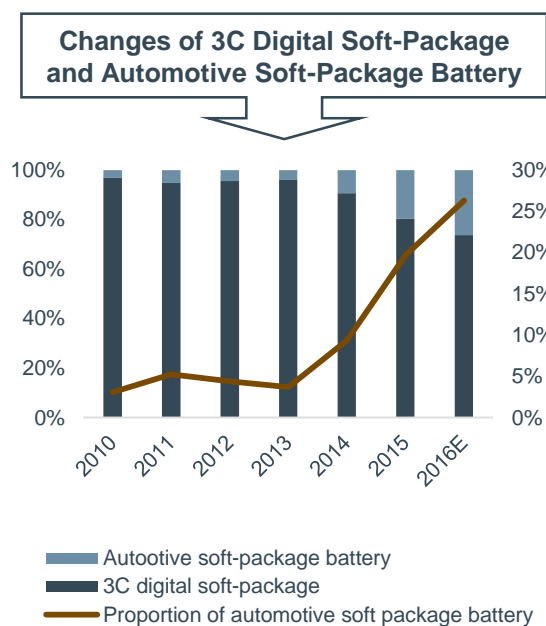


Sources: Zheshang Securities, SMM

3C : computer , communication and consumer electronics



Sources: Zheshang Securities, SMM



Sources: Zheshang Securities, SMM

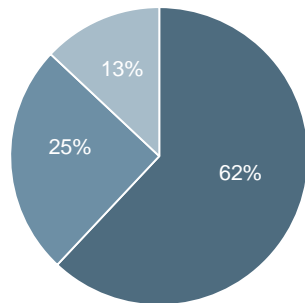
- **3C digital lithium-ion battery grew steadily during 2010-2016**, with **Compound Average Growth Rate(CAGR) of 20%**. Output is expected to reach 26GWh in 2016.
- 3C digital soft-package battery **developed rapidly during 2010-2016**, and the penetration rate hits **70% in 2016**, with **CAGR of 40%**. Output is expected to be 18.2GWh in 2016.

- Motive power lithium-ion battery grew slowly at first and then boomed during 2010-2016, with **CAGR reaching 93%**. Output is expected to amount to 26GWh in 2016, almost flat with 3C battery.
- Motive power soft-package battery developed slowly during 2010-2016, and penetration rate was only **25% in 2016**. Output will be only 6.5GWh in 2016 as cost for soft package products is relatively high.

- Output of 3C digital soft-package battery is expected to be **18.2GWh** in 2016, and that of motive soft package battery will be **6.5GWh**. **Soft-package battery will still be majorly used in 3C digital field.**
- 3C digital soft-package battery gradually enters into steady stage and any big growth will be unlikely in the foreseeable future. Motive power lithium-ion battery is still enlarging. Hence, motive power soft-package battery is expected to see drastic growth, and to become a new growth point for **soft-package battery market**.

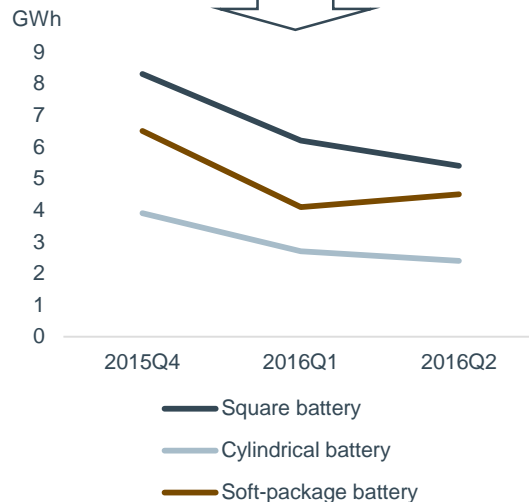
# In motive power battery market, soft-package battery tends to replace other products, with penetration rate expected to reach 50%

Proportion of Global Motive Power Battery by Type



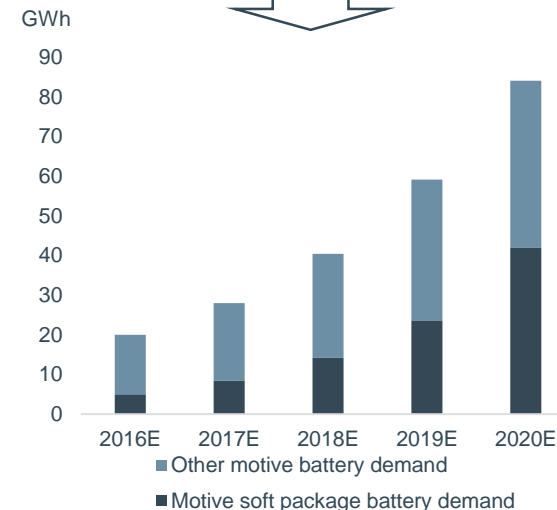
- Square battery
- Soft-package battery
- Cylindrical battery

Domestic Output of Three Types of Lithium Battery



Sources: Zheshang Securities, SMM

Motive Soft-Package Battery to See Increasing Penetration Rate



Sources: Zheshang Securities, SMM, qd-lib.com

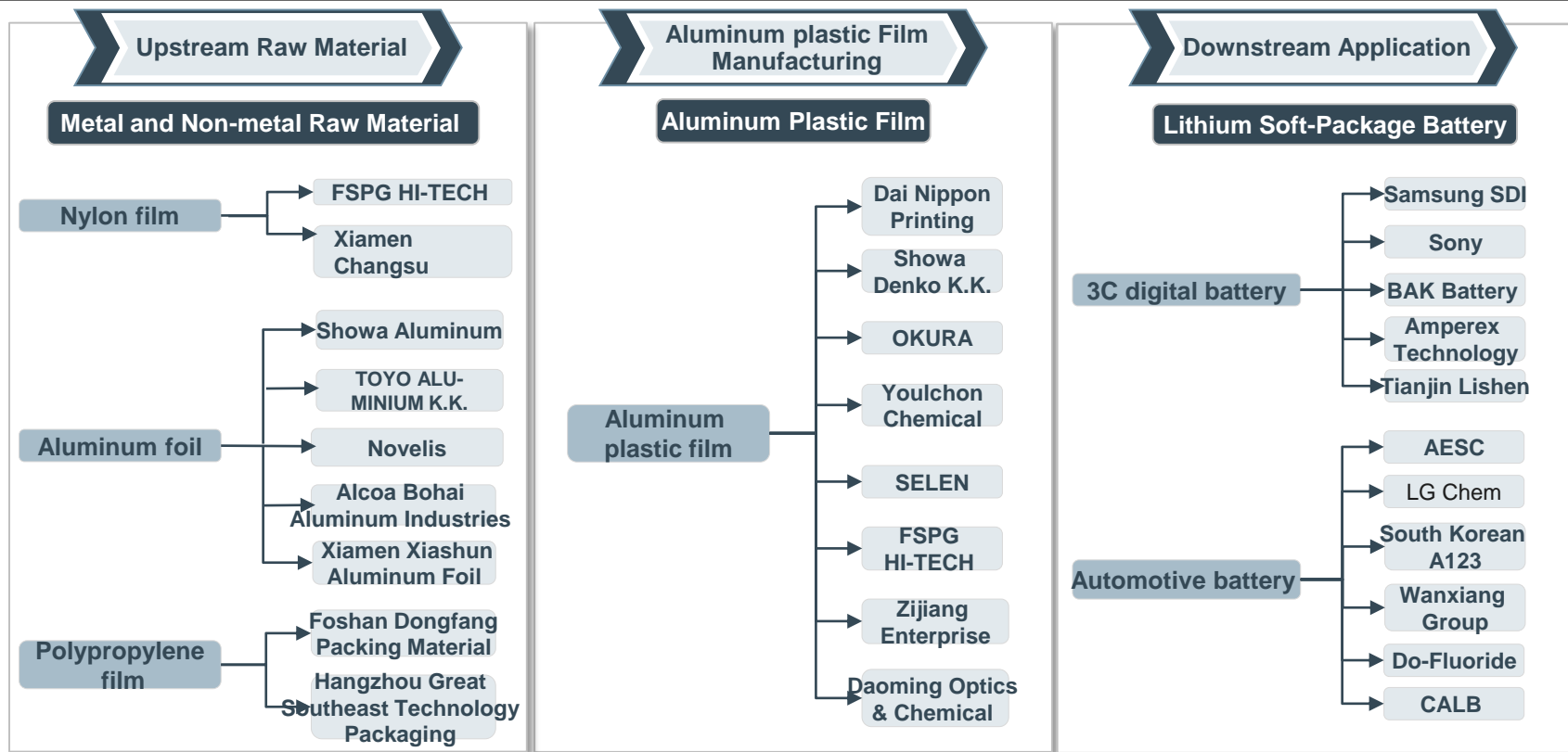
Sources: Zheshang Securities, SMM

- Over 60% of global motive power batteries are in square structure, the proportion followed by soft-package type, with cylindrical structure the least.
- In recent years, mainstream domestic electric vehicle producers have started to utilize soft-package motive batteries. Main battery suppliers are striving to invest in **soft-package battery industry**. Usage of motive power soft-package battery is expected to surge up drastically, with the estimated proportion to rise as well.

- **Domestic square battery output slid in Q2 2016** due to substitution of square battery by soft-package battery.
- Domestic cylindrical battery output dropped in **Q2 2016** as large relevant producers were reconstructing motive power batteries, but the shipment was limited because of policy.
- Domestic soft-package battery output rose in **Q2 2016** due to increased digital battery output and high **penetration rate of soft-package battery**.

- **Domestic motive battery output should increase noticeably during 2016-2020**, with Compound Average Growth Rate expected to reach **33%**.
- With growth of motive battery output, soft package battery output will also expand year by year. Penetration rate of soft-package battery will increase from **25% in 2016 to 50% in 2020 thanks to superior performance, and Compound Average Growth Rate will reach 58%, exceeding that of motive power battery's.**

# Industry Chain



**Raw material**-domestic functional film sees overcapacity, and aluminum foil technology does not meet standard.

- Domestic nylon film and casting polypropylene film developed late but rapidly, and faces overcapacity with low profit currently.
- At present, domestic aluminum foil processing technology falls behind compared to overseas standard, resulting in weak successive compound technology.

**Aluminum plastic film market** –strategy is the key in scrambling domestic aluminum-plastic film market share.

- Overseas aluminum plastic film with superior properties, entered into Chinese market early and enjoys good reputation among consumers, and takes a lion's share here.
- Domestic aluminum-plastic film develops late. Strategy should depend on price, logistics and service advantage, so as to expand market segment.

**Soft-package battery market**-3C digital battery market is steady, and emphasis on expanding automotive battery market.

- Mitsubishi iMiEV, MBW i3 and Toyota Pruis still adopt square batteries; Tesla Model S uses cylindrical  **motive power battery**.
- Newly-produced and developed vehicles will try the usage of soft package batteries in the future, e.g., Dongfeng Motor, BAIC BJEV and BYD.



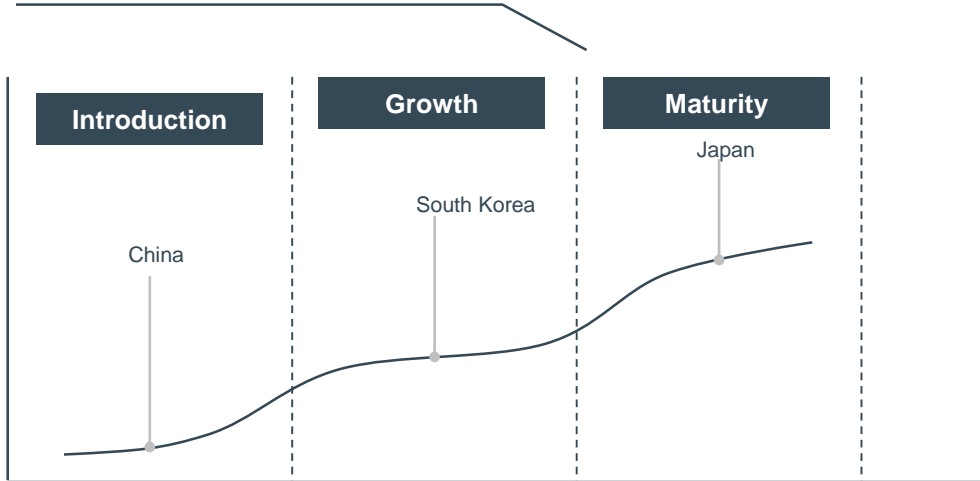
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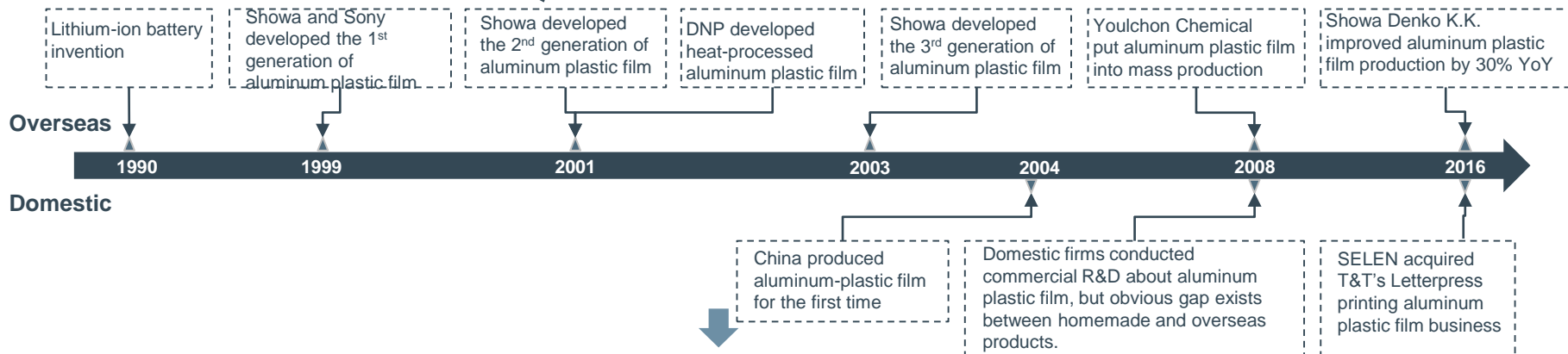
# Late to develop aluminum plastic film industry, China is still in introduction stage.

## 1. Domestic and overseas aluminum-plastic film industry stage



**Development of Aluminum plastic film**  
Japan's development and technology are the most mature. South Korea entered growth period, with gradual production release. **China is still in introduction stage, and technology lags behind, with only a few indicators meeting Japan's standard.**

## 2. Domestic and overseas aluminum-plastic film development process

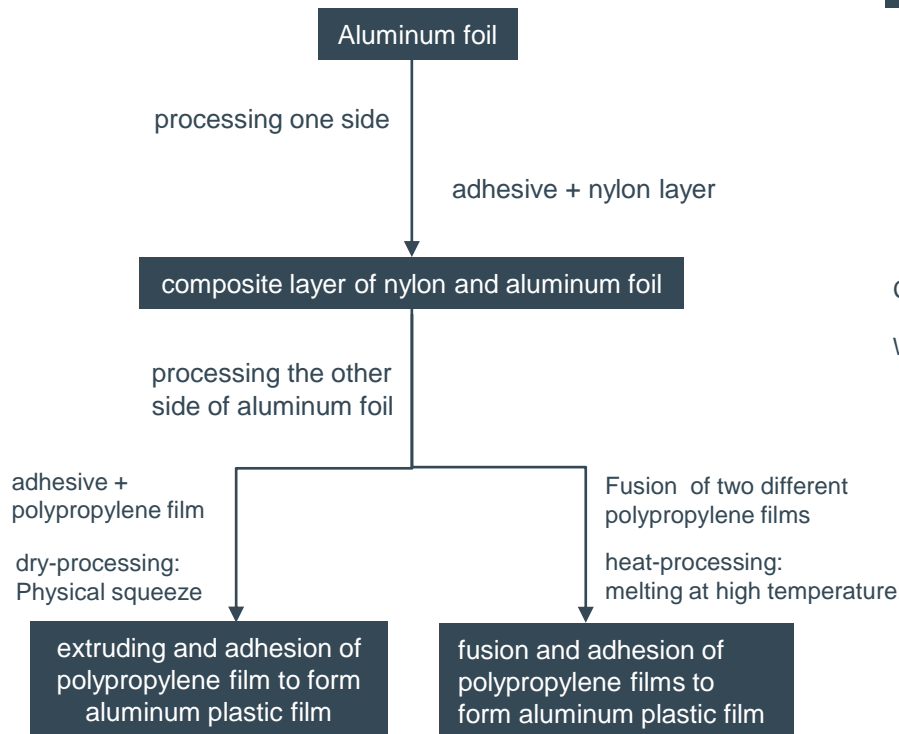


**Domestic aluminum plastic film developed quite late, but M&A is an efficient way to narrow the gap between foreign technology in the short term.**

# Properties of aluminum plastic film requires high standard, especially for deep drawing and corrosion resistance

- Aluminum plastic film manufacturing techniques mainly include dry- and heat-processing

## Aluminum plastic film process flows



Aluminum-plastic film raw materials: nylon film, aluminum foil, polypropylene film

**Dry-process:** after producing nylon and aluminum foil intercalation compound, **laminates** the aluminum foil and polypropylene film **again**.

**Heat-process:** after producing nylon and aluminum foil composite layer, covers one side of aluminum foil with the two different syncretic polypropylene films, and then bonds aluminum foil and polypropylene compound film by increasing temperature and pressure.

## Comparison of aluminum plastic film techniques

Difference	Dry-processing	heat-processing
Process	Extruding and compounding twice--shorter process route and more convenient to produce	Extruding once and compounding and high-temperature compounding once—more sophisticated and longer time to produce
Deep Drawing	Strong deep drawing ability; depth reaches 10mm via Japanese technology	Weak deep drawing ability; depth reaches 6mm via Japanese technology
Corrosion resistance	Good corrosion resistance against electrolyte	Extremely excellent corrosion resistance against electrolyte
Water-proof property	Good water-proof property	Excellent water-proof property
Utilization	Widely used in mobile phones, electric vehicles, model aircraft and other large, high-capacity automotive battery	Mainly used in battery requiring lower capacity
Representative producer	Showa Denko K.K	DNP

Sources: Zheshang Securities, industry information, SMM

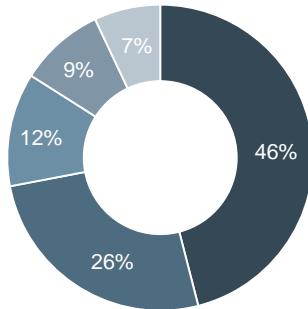
Aluminum plastic film requires high quality, superior deep drawing performance, excellent corrosion resistance to electrolyte, high puncture resistance and high temperature resistance ability.

Products applying dry-processing have better deep drawing performance, and those using heat-processing have high corrosion resistance ability. Automotive soft-package battery, which requires high deep drawing performance, mainly uses dry-processing in case of non-uniform pressure during packaging process.

Only a few indicators of self-developed aluminum plastic film meet Japanese standards, and the best depth in deep drawing is only 5mm, mostly utilized in the 3C digital field.

# Global aluminum plastic film market are mainly monopolized by Japan and South Korea

**Expected Proportion Of Aluminum Plastic Film in Global Market In 2016**



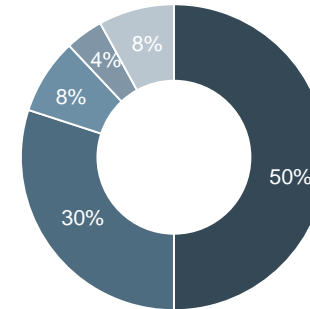
DNP
  Showa Denko K.K.  
 T&T
  Youlchon Chemical  
 Others

Sources: Zheshang Securities, CICC, SMM

Note: DNP, Showa Denko K.K. and T&T are Japanese companies; Youlchon Chemical is South Korean company.

- Global aluminum plastic film market has been dominated by Japanese companies for a long run. Oligopolies, Shodex and DNP, take up the largest share in global market, estimated to be 72% in 2016.
- **With** aluminum plastic film **capacity release by** T&T and Youlchon Chemical over recent years, the respective market share of DNP and Showa Denko K.K. **reveals slightly decline but they are still expected to account for over 70% in total in 2016.**

**Expected Proportion Of Domestic Aluminum Plastic Film in 2016**



DNP
  Showa Denko K.K.  
 T&T
  Youlchon Chemical  
 Chinese companies

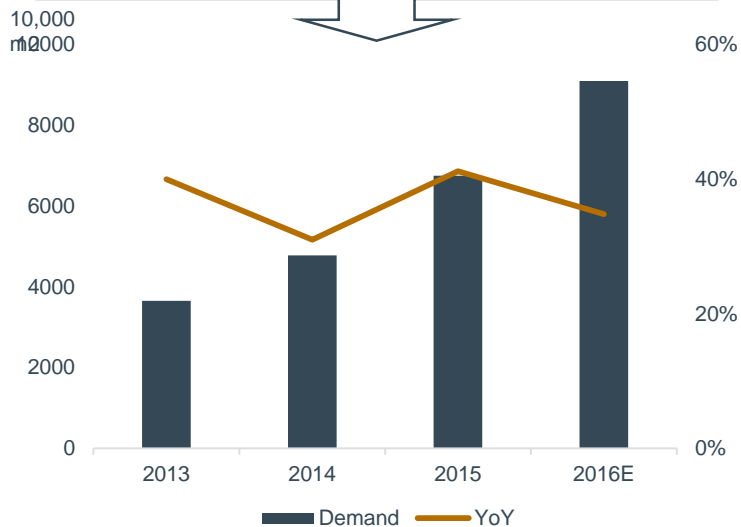
Sources: Zheshang Securities, CICC, SMM

Note: Chinese aluminum-plastic film producers include Daoming Optics & Chemical, Zijiang Enterprise Group, FSPG HI-TECH and Jiangsu Zhongjin Matai Medicinal Packaging.

- China relies heavily on import from Japan in aluminum plastic film field. About 92% of the market share results from importation in 2016.
- Producing aluminum plastic film requires top techniques. China has only a small number of aluminum plastic film producers, with the localization rate as low as 8%. Moreover, the homemade products are mainly used in 3C digital field, and consumption of automotive battery substantially relies on importation.

# Aluminum Plastic Film Is in Great Demand in China, and Gross Margin of Product Additive Value Reaches 50%.

**Domestic Aluminum plastic Film Demand And YoY Growth, 2013-2016**

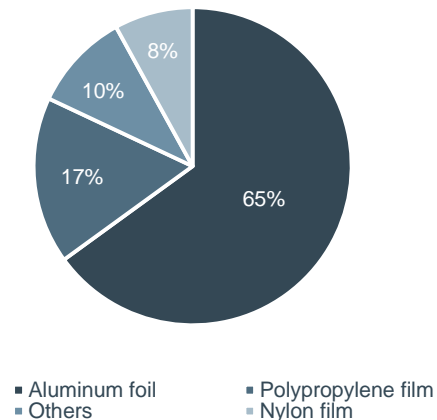


Sources: industry information, SMM

Domestic output value of soft-package battery reached RMB 32.5 billion in 2015, and demand for lithium aluminum-plastic film was 67.5 million square meter, with corresponding market size of RMB 2.15 billion, illustrating a rapid increase.

The development process of aluminum plastic film can be divided into two phases: by the end of 2014, the growth mainly benefited from the increasing usage of 3C digital soft package battery; since 2015, the development of automotive soft-package battery will be a focus.

**Cost Composition for Motive Power Battery Aluminum Plastic Film in 2016**



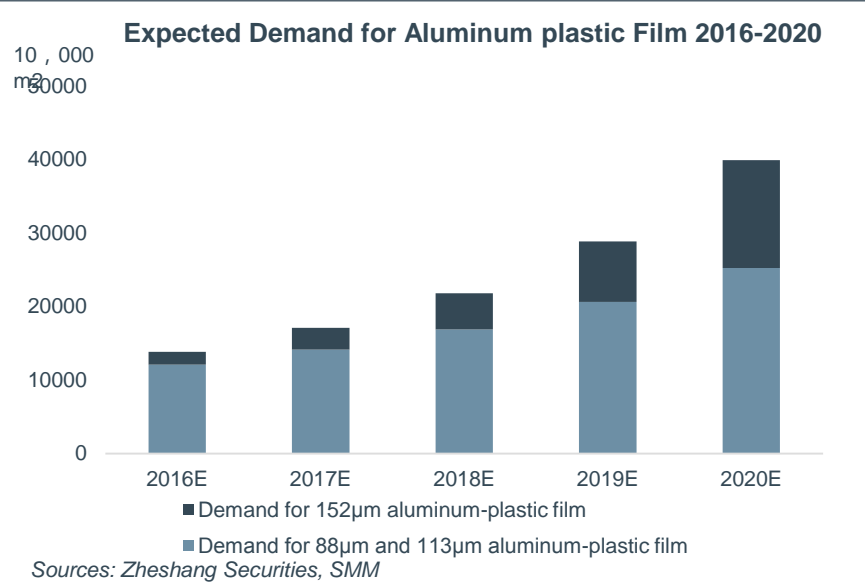
Sources: industry information, SMM

Thickness	Usage	Import price	Domestic price	Gross margin
88μm	Thin digital battery	RMB 25-35/m <sup>2</sup>	RMB 20-30/m <sup>2</sup>	40-50%
113μm	3C mobile battery	RMB 25-35/m <sup>2</sup>	RMB 20-30/m <sup>2</sup>	40-50%
152μm	Motive battery	RMB 35-45/m <sup>2</sup>	RMB 30-40/m <sup>2</sup>	50-60%

Sources: Zheshang Securities, SMM

# Localization of aluminum-plastic film will speed up thanks to motive soft package battery growth

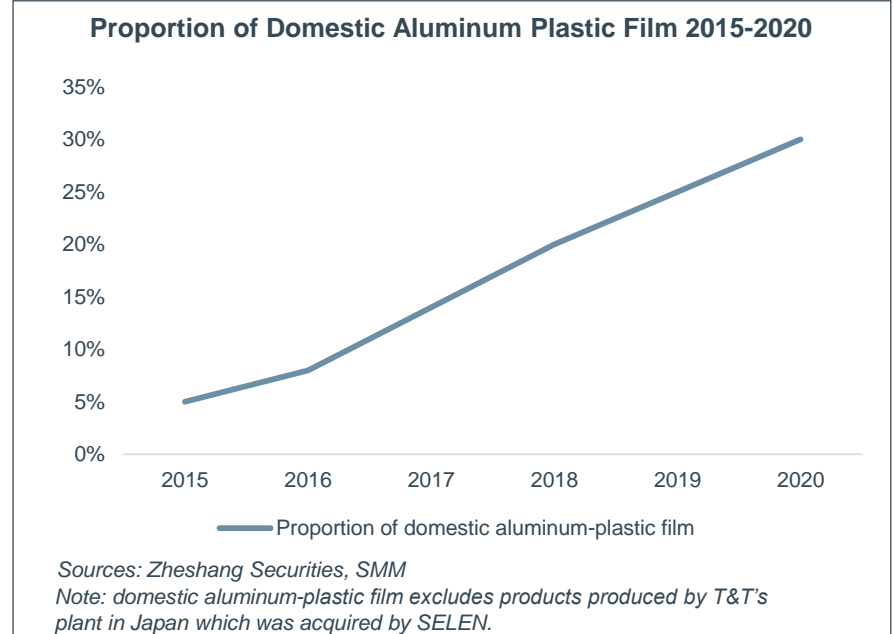
## Aluminum plastic film benefits from soft-package battery growth



Benefiting from the expansion of lithium batteries market and higher penetration rate of soft-package battery, **aluminum plastic film demand** is expected to hit 399.21 million square meters by **2020**, and the CAGR will reach 30% during 2016-2020.

Demand for 88,113µm aluminum-plastic film used in 3C digital products is strong, and it will increase steadily till **2020**. **Demand for 152µm aluminum-plastic film used in automotive batteries will keep growing rapidly till 2020.**

## Market share of domestic aluminum-plastic film is expected to rise



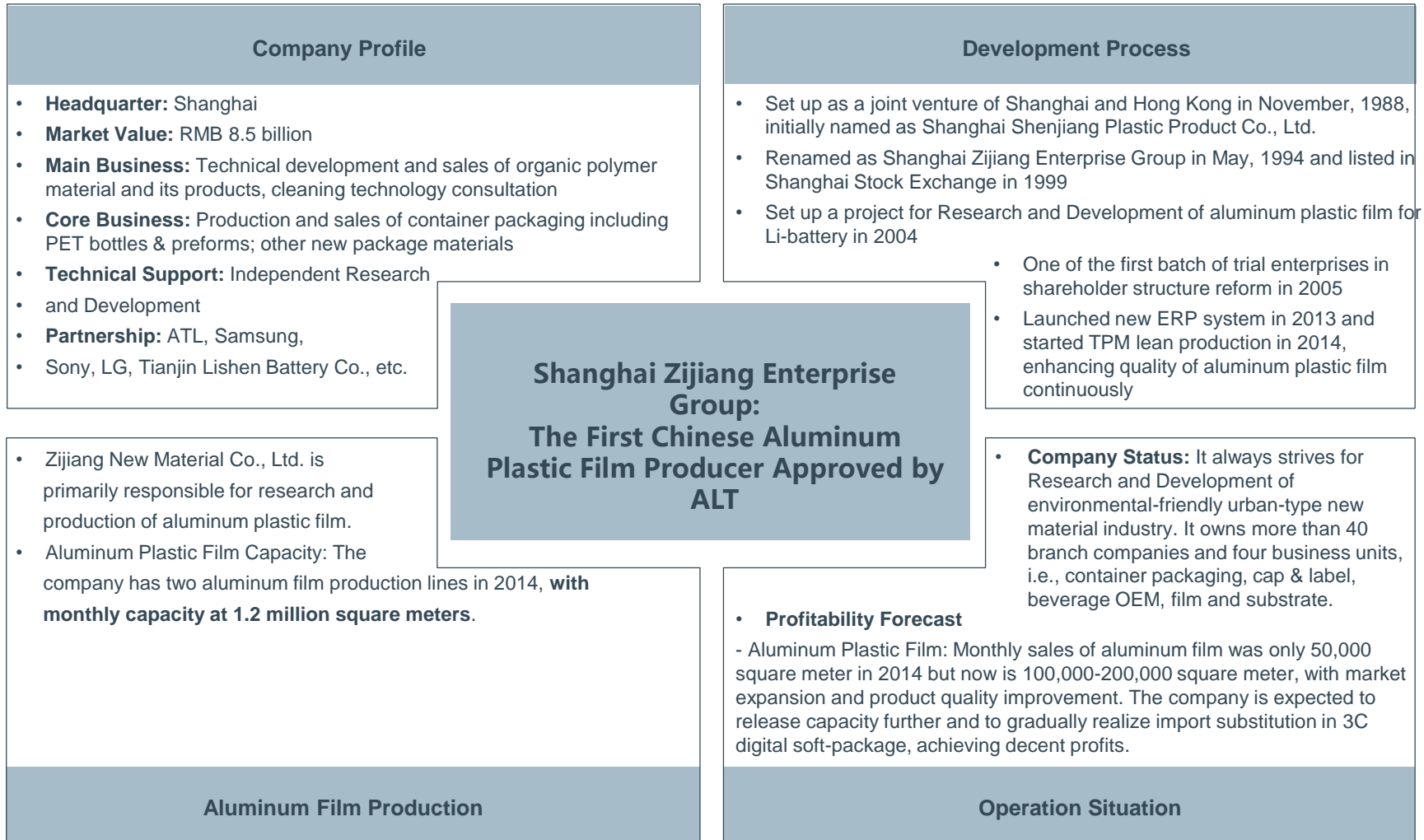
By 2020, domestic market share of aluminum plastic film is expected to rise to 30%. Despite slight improvement in localization, foreign products will continue to dominate the market due to technology gap between domestic and foreign products.

Technical indicators at domestic **aluminum-plastic film producers such as** Zijiang Enterprise have become increasingly mature, and achieves more sense of recognition by the market. These products will be mainly used in 3C digital soft-package battery in the future. SELEN acquired Japan's T&T and built plants in China capitalizing on T&T's technology. Its products will be mainly used in automotive soft-package battery in the future. As such, localization of aluminum plastic film will be pushed up.

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# Domestic Representative Enterprise: Selen Science & Technology

## Company Profile

- **Headquarter:** Shenzhen, Guangdong province
- **Market Value:** RMB 7.3 billion
- **Main Business:** Technical development and sales of organic polymer material and its products, cleaning technology consultation
- **Core Business:** Aluminum plastic film, TAC functional film and PBO fiber
- **Technical Support:** Toppan Printing Company, Higashiyama Film
- **Partnership:** Panasonic, many Chinese enterprises

## Development Process

- Set up in Dec. 2002 as a national hi-tech enterprise and the leading supplier for anti-static and cleanroom products integration system
- Listed in Shenzhen Stock Exchange in 2010
- Expanded its business in new material industry, in 2013
- In 2015, transformed to New Materials industry, symbolized by the operation of Changzhou New Materials Industrial Park
- In 2016, acquired aluminum film for Li-battery business from Toppan Printing Company and strived to be the leading aluminum film producers in China

## Chinese Potential Leading Aluminum Plastic Film Producer: Selen Science & Technology

- **Overseas Capacity:** Monthly aluminum plastic film capacity by **Triple, Japan**, is **2 million square meter in 2016**.

- **Domestic Capacity:** The company built a new aluminum plastic film production line in Changzhou, totally adopting Japanese technology, with estimated **monthly capacity at 3 million square meter**.

- **Company Status:** The company expands business in various industry based on leading anti-static and cleanroom products, such as new material sector.

### Profitability Forecast

- **Aluminum Film:** Mid- and high-end aluminum film is mainly depends on import. After the construction of domestic Aluminum film production line, import substitution can be realized, with high profit.
- **TAC Functional Film:** Cooperating with Higashiyama Film, Selen has reached target output in stage 1, breaking the foreign monopoly.
- **PBO Fiber :** Built the first PBO production line in China, which is in large scale and profitable.

## Aluminum Film Production

## Operation Situation

# Domestic Representative Enterprise: Showa Denko

## Company Profile

- **Headquarter:** Tokyo, Japan
- **Capital:** 140,564 million yen
- **Main Business:** Petrochemistry, chemicals, electronics, inorganics, aluminum and materials for Li-ion Battery
- **Relationship:** Subsidiary of Mizuho Financial Group
- **Branches in China:** 11 branches in China in total—6 in Shanghai and 5 in other regions.

## Development Process

- Merged with Nihon Electrical Industries to form Showa Denko K.K. in 1939
- Listed in Tokyo Stock Exchange in 1949
- Expanded international business via acquiring United Technologies and Mitsui & Co. in 1974.
- Merged with various companies during 2001-2003
- In 2010, merged with Showa Highpolymer Co.,Ltd.
- Conducted new medium-term consolidated business plan "PEGASUS" during 2011-2015
- Started its medium-term operation plan during 2015-2020

## Global Leading Aluminum Plastic Film Producer: Showa Denko

- **Aluminum Foil –Raw Material for Aluminum Plastic Film:** The company has 4 production lines for aluminum foil, with rolling width at 1,830mm.

### Aluminum Film Capacity:

Monthly capacity was 3.8 million square meter in 2013;  
 Monthly capacity was 5.7 million square meter in 2014;  
 Monthly capacity was 7.4 million square meter in 2016.

- **Company Status:** SDK is a well-known global comprehensive group and producer who provides various raw materials for Li-battery. Most of its products are cutting-edge with large sales volume and decent profit.

### Profitability Forecast

- **Aluminum Plastic Film:** SDK is optimistic toward Li-battery package market and keeps expanding investment in aluminum film business, leading to rapid increase in capacity.
- **Anode Material and Additives:** Company's Li-battery raw materials business develops sharply with high profits, such as anode material, thanks to development of Li-ion battery.

## Aluminum Film Production

## Operation Situation

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# Industry Opportunity and Investment Focus

## Raw Material

### 1 High-end Aluminum Foil

- Although the number of rolling aluminum foil production lines in China surpasses other countries, e.g., Japan and South Korea, products properties are in the lower end. There exists output surplus in the domestic market. Meanwhile, domestic market relies on import in terms of high-end aluminum foil, which has high additional value after being made into aluminum film. The expanding aluminum film market size will benefit the development of high-end aluminum film.

## Aluminum Plastic Film

### 1 88, 113 $\mu$ m Aluminum Film

- The products can be used in 3C digital soft-package battery category, film usage of which will see a **decelerated growth forward**, but due to large basis and lower technical requirement than automotive battery, import substitution can be realized gradually.

### 2 152 $\mu$ m Aluminum Film

- The products are mainly used for soft-package of automotive battery, which requires high property and rewards high profit with high technical entry barrier. Demand will ascend sharply with the rapid development of automotive battery later on.

## Soft-package Battery Production

### 1 3C Digital Soft-package Battery

- Development of 3C digital Soft-package battery market has entered into mature period. Encountering fierce competition, enterprises have to reduce cost to increase profit. Using homemade aluminum plastic film helps realize cost reduction.

### 2 Automotive Soft-package Battery

- The rising of Li-battery demand and penetration rate of soft-package automotive battery will foster the development of automotive soft-package battery industry. However, the pace will be restricted by high price of aluminum film.

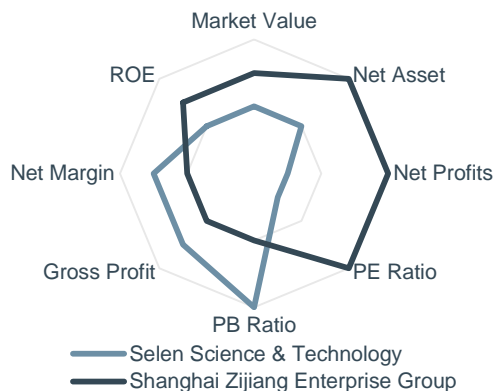
### Investment Advice:

- Zijiang New Material**, joint subsidiary of Zijiang Enterprise Group, is specialized in research and development, production and sales of aluminum plastic film for Li-battery with properties reaching international advanced level. The products are mainly applied in digital, automotive and storage Li-ion battery areas. Zijiang New Material has been in batch production, and supplies products for firms including ATL and Tianjin Lishen Battery.
- FSPG Hi-Tech** is a leading new plastic material producer in China, and aluminum plastic film is its vital self-developed new material. It is mainly used in polymer battery for small digital devices, such as mobile phone and laptop, and in soft package for Li-battery. The product has not been produced in large scale since it is still under pilot trial period.
- Selen Science & Technology** acquires the capacity, right to the use of trademark and patent from T&T, and will build factories in China. The property and the yield of its products are expected to reach the same level in Japan. The factory is capable to produce aluminum plastic film by 600 million square meters per month, accounting for 20%-30% in domestic market share. Meanwhile, the company cooperated with Higashiyama Film, becoming the leading TAC film producer in China.
- Daoming Optics&Chemical**, its main business is about r&d, design, production and sales of reflective material, clothing and other reflective products. Aluminum plastic film made by Daoming is mainly used for soft package of Li-battery and most polymer Li-battery. The corresponding production project has started since Q2, with **annual output estimated around 15 million square meters**. It has received a small amount of orders, and the output in 2016 will depend on sales.
- Shenzhen Beauty Star** mainly involves in producing plastic package for makeup, commodity, health care products and food, and providing solutions for vehicle lightweight. Its stock joint subsidiary firm, Shenzhen Lidefu New Energy Company, is planning a Li-battery Al compound packing film project, which has finished research and development and obtained patent license but has not entered it into mass production yet.

# Corporate Financial Analysis: Selen and Zijiang

## 1. Current Financial Index Analysis

Financial Index Comparison



Data Source: Enterprises' Q3 Report, SMM

Financial Index in Detail

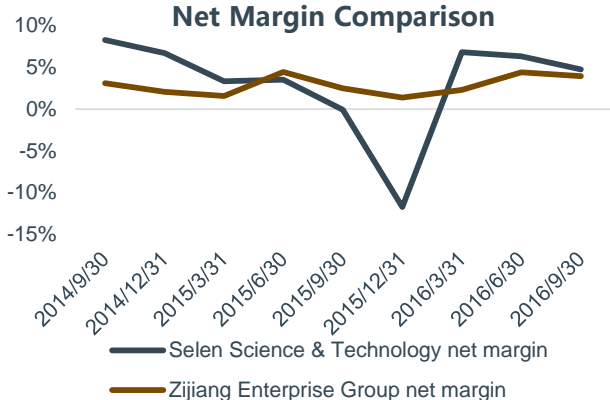
Firm	Market Value	Net Asset	Net Profits	PE Ratio	PB Ratio	Gross Profit	Net Margin
Selen	7.34 billion	1.55 billion	51.6 million	106.8	4.92	29.66%	4.75%
Zijiang	8.57 billion	4.45 billion	246 million	26.2	2.04	20.73%	3.95%

Data Source: Enterprises' Q3 Report, SMM

- Selen has stronger profitability but its PE ratio is too high. The stock price might drop substantially if the company fails to meet the market expectation in future. **Therefore, it is fit for aggressive investors.**
- Zijiang, developing in mature stage with abundant asset and stable profitability, **is more suitable for conservative investors.**

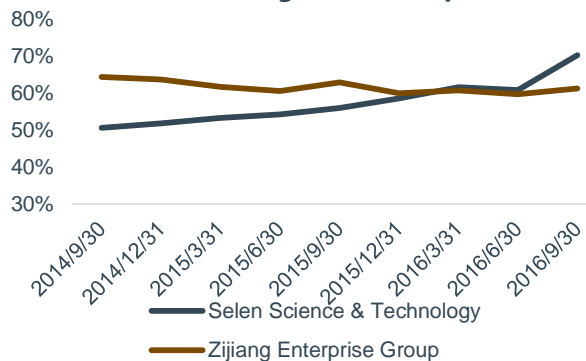
## 2. Historical Financial Index Analysis

Net Margin Comparison



Data Source: Company's annual report, semi-annual report, quarter report, SMM

Net Gearing Ratio Comparison



Data Source: Company's annual report, semi-annual report, quarter report, SMM

- Net margin performance of Selen is volatile, ranging from -10% to 10%. Its business is still under development stage, while Aluminum plastic film project are expected to be highly profitable forward. The company might suffer from its sharp rise of net gearing ratio. Thus, it is fit for short-term investment.
- Zijiang develops stably with the recent average net margin at 2.84%. Its net gearing ratio is also reasonable. Therefore, it is more suitable for long-term investment.

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