Toyo Aluminium
– to make a more sparkling tomorrow –
for people and for the earth

Aluminium that does not conduct electricity. Aluminium that is attracted to magnets. Colorful aluminium. Aluminium resistant to corrosion. Our aluminium has already exceeded the general concept of aluminium, broken out from the barriers of the field and permeated widely and deeply into our daily lives and society. We hope to further advance the appeal of that aluminium and develop a sparkling future. We want to make the Earth full of life. To do that, we ourselves must be dazzling. The “Sparkling for Earth” slogan shows that our passion to that vision is unchanging. We will continue to listen to our customers and look to the future as we discover and offer new values for aluminium. We truly believe that our ever changing world will provide an opportunity for us to realize the unlimited potential of aluminium.

* The “Sparkling” in the slogan is chosen for its meaning as “dazzling and full of life.”
Aluminium technology at the microscopic level – using the interference of light to create colors without pigments

CHROMASHINE®

When viewed from one angle it looks navy blue, but from another it looks violet. Or perhaps something looking gold from one angle looks green from another. Using our ground-breaking aluminium technology we can enter this strange and exciting world of colors without the use of conventional pigments. This is the CHROMASHINE series. The phenomenon is occurring in the realm of aluminium flakes measuring just a few tenths of a micrometer. By using the interference of light, we design our products so that a particular wavelength of light is emphasized when seen from a particular angle. The CHROMASHINE technology is an extremely high-level technology realized by a combination of three of our core competencies: surface treatment technology, powder plating technology and composite technology. We are currently developing a number of applications for it, including cosmetics and printing inks.
The lotus was our teacher

Another unique world-changing technology derived from a hint from nature.

Water-repellant packaging - ground-breaking packaging materials developed with nature as a model

TOYAL LOTUS®

What do you do with the yoghurt that sticks to the back of the lid? We made it so the yogurt doesn’t stick. That is the TOYAL LOTUS technology, a world-first technology with a 3D mesh fractal structure, which took over 10 years to develop. The idea was greatly aided by hints from lotus leaves. Yoghurt is sticky and does not roll on lids made with usual processing and materials. However, it does roll about on lotus leaves. We researched the surface of the leaves and managed to achieve the same structure through aluminium processing techniques. Nature is amazing. What we want to do now is further this technology and expand its uses from foods to medical and industrial materials and to reform the world of packaging.
A non-aluminium hit from an aluminium company

It took an aluminium company from Japan, the country of long-life, to protect the health of solar power generating systems.

Highly durable back sheet materials to extend solar cell module life

Toyal Solar®

Actually, Toyo Aluminium has some products that aren’t aluminium. The representative one is Toyal Solar. One challenge for solar generating systems, that are expanding rapidly, is the need for improved durability. They need to be able to withstand long periods of outdoor exposure, under extreme conditions, yet against these demands, our ground-breaking backsheets material has the best in class industry performance. It is a composite film which was developed by exploiting the aluminium processing techniques and know-how we have accumulated over the years. It is extremely resilient to water, successfully achieving a dramatic improvement in solar cell module life. It takes a share of the market on a global scale. It can be used for all types of solar cell, for example crystal, amorphous and composite types. We intend to keep challenging ourselves to adapt our aluminium technologies to make products made of substances other than aluminium.
In a sense - the ultimate symbiosis

Just like symbiosis in the natural world, the strong bonds of our discovery have made it into the world standard.

A core technology that is expected to be used in energy components in the 21st century

TOYAL - CARBO®

It all started from mysterious whiskers which grew from aluminium foil in an experiment. By linking with carbon, the adherence to the aluminium foil was stronger than when just coating. The discovery of this phenomenon brought about the creation of TOYAL - CARBO, the de facto standard for functional solid polymer capacitor cathodes. Compared with electrodes produced with the traditional attachment of carbon using adhesives, the TOYAL - CARBO electrodes have a low resistance under any conditions, which means that the performance of functional solid polymer capacitors is instantly improved, making miniaturization possible. It became an essential element of advanced electronic appliances such as LCD televisions and high-performance laptop computers. Furthermore, high expectations are being placed on the technology for its application to energy components for the 21st century, for example in lithium-ion batteries and in electric double-layer capacitors. This is one of our core technologies, and one that we are very proud of.
We don’t allow the word “impossible” into Toyo Aluminium’s dictionary.

Our aluminium technologies attempt to break into fields previously thought impossible for aluminium.

Through our various processing technologies, we have made the use of aluminium possible in fields previously thought impossible. These include products that can be used where there is water, products that are resistant to acids and alkalis, products that can be used in microwave ovens, and aluminium that can be used safely and without odors for foodstuffs. We intend to continue expanding the range of uses for aluminium.

To make it more beautiful, stronger and more functional, Aluminium will become one of the key materials of society, producing new items for the future.

Aluminium which is beautiful and colorful

We offer a careful world with our various technologies, such as surface treatment techniques, dispersion techniques and printing techniques.

Aluminium which is resistant to chemicals and moisture

By adapting coating materials and additives, and by developing aluminium with a lower exoerience of phthalate, we improve the moisture-proofing of the aluminium and therefore the reliability of the products.

Aluminium which blocks UV radiation and solar heat

This product is stuck to a glass window to cut solar heat and UV radiation. It is a product to help in measures to stop global warming.

Aluminium which is microwave-safe

By using our unique precision techniques, we offer a packaging material that can be used for cooking in microwave ovens.

Aluminium which has superior environmental performance

Among others, we offer aluminium pigments for use in water-based paints and powder coatings, and also aluminium pigments for injection molding which do not contain solvents.

Aluminium to advance battery technology

We offer battery materials for many uses, for example for cathode current collectors on lithium-ion batteries.

Aluminium which is highly resistant to corrosion

As a result of research into unique aluminium alloy compositions, we succeeded in developing aluminium foil which is more resistant to corrosion than was previously possible.

Aluminium which reduces energy consumption

We promote reduced energy consumption and reduced space for refrigeration, etc., by offering packaging materials utilizing very thin film aluminium foil.

Aluminium for the visual age

This highly reflective product improves the brightness and appearance of LCD televisions and displays, etc.
The origin of aluminium to make the future bright

We are pursuing a materials revolution in order to produce aluminium that will brighten up the future.

In addition to working to improve the efficiency of research and development and to further strengthen and protect the company's core competences, we are not restricted by conventional wisdom and work to achieve "product development that impresses the customer and matches the needs" and "the development of revolutionary products that have an impact on the customer and create the needs." The new technologies and new functionality materials created here are sent out for customers in the world and recreated, there products which are friendly to the environment and society.

Research and Development

We create the future with unique technologies and products.

Toyohashi Alumina established the world's first general research laboratory for aluminium foil at the Yapo Works in 1964 and went on to establish a research section for aluminium paste in 1967. Ever since that time, the research and development division has continued to perform fundamental and applied research as the core department in Toyohashi Alumina.

There is also a wide range of other research and development activities performed here. With the existing core technologies and products as a foundation, these activities include innovative ideas and creative techniques to develop the next core technologies and also research with a medium and long-term perspective in fields predicted to become big markets. These positive research and development activities are supporting the company's position as a top manufacturer of aluminium foils, powders and pastes.

Intellectual Property

We protect our unique technologies and products.

The Toyohashi Group has developed many original products and technologies over the years and that superiority has been protected and utilized as intellectual property. We perform investigations of the prior art, the monitoring of patents published and the handling of technological and intellectual property contracts and we also work to educate employees on Intellectual property.

Technology Control

We nurture unique technologies and products.

The strategy for the creation and nurturing of new technologies and new products is essential. It is also necessary to manage the progress of each research project ongoing and to determine whether or not the commercialization of those products will be acceptable. After first investigating new research themes that could be pursued over the medium and long term, it is important to select and focus on whose themes are promising with respect to the realization of the product commercialization. When there is good matching to the market needs, those technologies and products will then go on to develop and grow.

We are developing next generation technologies for 10 or 20 years into the future.

From a foundation of conventional uses and fields, our aluminium technology is showing an expansion into new business areas. The research and development division is continuing research into aluminium that will make the future shine brilliantly, including with the development of new functionality materials for solar cells, which lead to achieve ever higher performance. Research is also continuing on the development of new electrodes for lithium-ion batteries and next generation capacitors, the development of high functionality materials with unique alloying, and the development of aluminium powders and pastes for new designs and new applications.
Based on our commitment to environmental protection, we hope to expand the future of aluminium to provide solutions for customers facing challenges across a wide range of business fields.

**Foil Business**
We aid our customers’ technological advancement by offering high-functioning and high-performance materials. We meet directly with customers to investigate the problems they have and then develop and offer original products using our unique technologies and knowhow. We also offer solutions for raw material and energy consumption reductions by using our lightweight but high-performance aluminium foil, and solutions using high-functioning and high-performance materials for future products, including products which are more environmentally friendly, such as high-performance compact capacitors and lithium-ion batteries.

**Paste Business**
Composites and applied technology that make possible what was previously impossible for aluminium, to respond to the needs of an environmentally friendly society.

We will continue to develop our products in search of higher aesthetic values, but also to improve their functionality. We will utilize the surface treatment technology refined over many years of research and development, to meet or exceed customer expectations. All of the new, global vehicle systems whether the goal is unique and market driven metallic colors, improved chemical resistance or stability in waterborne coatings systems. Our goal is to not only be better than our competitors but also to be different from our competitors. From our position as 'best in class' we are looking at new opportunities in new markets such as packaging for food and beverage products.

**Powder Business**
We will contribute to the realization of an environment-oriented and energy-saving society through the use of aluminium powder and its application in products.

We have contributed to growth and development in the fields of chemicals, electronic materials, automobiles and aerospace by offering our aluminium powder and its applied technologies, including aluminium alloy powders, aluminium nitride powders and functional aluminium inks. We will continue to utilize the superior properties of aluminium powder to extend the applications for it.

**Photovoltaic Business**
We will pursue the possibilities of aluminium in environment-related fields such as solar cells.

We focus on business related to environmental protection and other green markets and have a system in place to make it easier to deal with issues speedily and in very fine detail. The Division has worked to increase its speed, for example by having Sales Staff with technical knowledge that enables them to make judgments and deal with the issues on the spot. In addition, the division is paying particular attention to the solar power generation business overseas, especially in China, and offers products with its unique technology, primarily in the environmental business field.
Foil Business  Technology and product introduction

The new functionality aluminium spreads ever wider

The range of uses increases with new application techniques and composite technologies.
Aluminium foil has excellent chemical and physical characteristics, including its moisture-resistance, aroma retaining properties, thermal conductivity, electrical conductivity, thermal insulation properties, light blocking properties, hygiene, beauty and workability. With our latest techniques, we can freely control the thickness of aluminium foil and by paying minute attention to the processing, for example to control distortions and crease problems, we produce products which have excellent looks, have few pinholes and are suitable for multi-colored printing. A wide range of applications includes use as packaging for foods, pharmaceuticals and in decorations and daily essentials. They are also used as shielding when combined with resins and films in electrolytic capacitors when the functionality is raised, and also as aluminium alloy films. The use for aluminium foil are also increasing in the environmental-related business field.

Improving the performance of electronic devices
TOYAL - CARBO®

The aluminium foil with carbon particles without using binders performs stable low resistance as a electrode under any environment. This excellent characteristic has realized the miniaturization and improved performance for a polymer capacitor. There are also high expectations that the new product will be applied for a lithium-ion battery.

Contributing to the realization of new energy devices
TOYAL PASS®

This is a functional material of aluminium foil with high population density of holes of 1 micron or less in diameter. It is employed as a collector of the positive electrode for a lithium-ion capacitor. The new low internal resistance of the energy device is widely applied for automotive and backup power supplies.

Corrosion and electrode using aluminium powder and foil
Powder laminated foil

A compound electrode is developed by depositing aluminium powder and aluminium foil. The population density of the aluminium powder is controlling the porosity demanded on the application. Furthermore, the binding strength between the powder and the foil is tough enough in various fields. By selecting the coating method, it is also possible to set perforation in some other designs.

A superior response for high mechanized packaging
AL-PRESS®

These are perfect blister packs with both the top and bottom made of aluminium foils, which respond to the need for high moisture-proofing PTP. As an aluminium packaging material it has excellent formability, stability and sealing properties, and has shown outstanding results.

A precise bonding covering that prevents trouble
Child Proof "

This is the child resistant anti-tamper Blister packaging that uses a protection film layer. It is possible to control the peel strength freely by dividing the peeling patterns. Various available include the strong performance type, on which the package is separated along the slit line and then the grip tabs appear, and the pull up type, which functions to prevent tampering and tearing during reception and displaying for selling.

Genuinely measures and naturalizes
Etching circuit foil

We have developed antenna circuits for high security applications by using a high adhesion/low IR conductive foil which make it difficult to remove the antenna and chip without damaging them. We also have structures that contribute to forgery prevention and circuits that make it possible to mount compact chips. This technology is ideal for cards that require high-levels of security,gements, prepayment cards and credit cards.

99.95% aluminium foil (high purity)

99.8% aluminium foil

99.9% aluminium foil

Aluminium alloy foil

99.8% aluminium foil

Thickness

Paper containers for liquids such as milk, juice, etc.

Recent pouches for chocolate, chewing gum, etc.

Laminated tubes

Medicines and health food packaging

PP/Paper packaging

Plastic containers for dry goods, tea, coffee, clothes, etc.

Supermarket

Innovative packaging foil containers

Food storage, etc.

Folded metal canisters

10cm

5cm

7cm

10cm

15cm

20cm

25cm

90cm
Paste Business Technology and product introduction

Aluminium technologies to further environmental protection

We offer various solutions with our extraordinary aluminium technologies.

The main ingredients of our aluminium pastes are high purity aluminium powders and fillers. The pastes have uniform particle size. Furthermore, they are uniformly coated with fatty acids, giving them superior resistance to moisture and light and excellent design characteristics, as well as making them lightweight, safe to handle, and economical. The registered trademark "ALPASTE" is therefore popular for metallic coating on automobiles and in feld printing. We have also developed environmentally friendly treated products for wokasme systems and products with superior chemogetic and functional characteristics.

Gentle on the environment  
Treated Alpase for wokasme systems

Aluminium paste which does not conduct electricity  
Resin coated Alpase

Switching to environmentally friendly solvents  
The TD Series for printing inks

A new kind of sparkle  
Colored Alpase

Offering a new sparkle  
Interference color aluminium pigment, "CHROMASHINE"

Beautiful vivid color travel  
Interference color aluminium pigment, "Cosmicolor"

Ultra weather resistant metal filler  
Stainless steel flakes

Electricaly conductive plating filler/Electricaly conductive aluminium ink for sintering

We are continually striving to achieve new levels of metallic sparkling. Extremely colorful and vivid metallic coats can be achieved with our "Friend Color" aluminium flakes, which have color pigments attached and are coated with resin.

We are continuously striving to achieve new levels of metallic sparkling. Extremely colorful and vivid metallic coats can be achieved with our "Friend Color" aluminium flakes, which have color pigments attached and are coated with resin.

Using the interference of light, a completely new type of metallic pigment was developed which appears to be different sized depending upon which angle the object is viewed from. In addition, the conventional use of thin coating and printing ink, its opening up new design possibilities in various fields, including cosmetics (with "Cosmicolor") which we offer.

This is a completely new type of metallic pigment, with a bare of aluminium flakes covered with a surface layer of silica and then plated with metallic pigments. The difference in optical paths between the reflected light from the painted layer and the reflected light from the aluminium flakes causes strong interference colors. "Cosmicolor" has a silica coating as a final protective layer and the size of aluminium as a base material means that it has superior hiding power compared to other interference pigments.

These are metallic materials for resin injection molding which are both beautiful and, they have the following characteristics:

1. "High

2. "High

3. "High

4. "High

5. "High

Our electrically conductive filler containing copper and silica particles and flakes evenly plated with silver is proposed for various items that could not previously have been achieved with electrically conductive fillers. Our aluminium ink for sintering using aluminium powder and flakes can be altered to meet various requirements by changing the particle diameter, resin and binders. (The photograph shows the cross section of the aluminium ink after sintering.)
Powder Business
Technology and product introduction

Powder products that contribute to society

Aluminium has excellent properties by making it into fine powders, some new properties are also added. Aluminium powder is now used in various industrial fields just as it is, but processing the aluminium powder even further gives it new functions and opens up completely new applications. We will continue to examine this aluminium powder, and the infinite possibilities it offers, and we will work to exploit its excellent potential to the full to make a contribution to future society.

Brazing freely
Paste for aluminium brazing, “Toybal Hyper Braz®”

Excellent heat dissipation and insulation
High-purity aluminium nitride powder, “TOYALNITE®”

Superior wear resistance
Aluminium-silicon powder, “POWDALLOY®”

> Fields of applications
- Food and daily essentials
- Medicines and chemical products
- Industrial and construction materials
- Electronic equipment

Extension of solar module life and contributing to the global environment
High-durability back sheet material, “Toybal Solar®”

This composite film, which is used on the back of solar cells, to effectively protect the silicon cells, the central part of the solar cells. It has an extremely excellent hydrolysis resistance and dramatically extends the lifespan of solar cell modules. It can be used for all types of solar cell, for example crystal, monocrystalline and polycrystalline, and customization is now customer demand is possible.

In order to change the sun’s light into electricity more efficiently
Solar cell rear electrode ink, “ALSOLAR®”

The “ALSOLAR®” ink further increases the power generating efficiency of solar cells. A stable quality is achieved by having a shaped production system from the raw material aluminum powder. Continuous improvement from the powder stage to meet the customer’s specifications for cell capacity and characteristics, etc. We are also supply brazing materials, etc. with aluminium technologies we have developed so far to aid in power generating efficiency improvements, the most important issue for solar power generation systems.

Photovoltaic Business
Technology and product introduction

Aluminium materials making a contribution

Solar cells is one area of business that we are focusing on as a future growth market. Needless to say, we are focusing on our highly regarded “Toybal Solar®” back electrode ink for solar cells, and “ALSOLAR®” rear electrode ink for solar cells. However, we will also consider the needs of the market and pursue the possibilities of aluminium as a material, either by going beyond the limits of the film and paste technologies we have cultivated so far, or by finding new ways to combine them. We will enhance the environmentally-friendly characteristics of aluminium materials, achieve higher functionality, and proceed to extend the products globally, to aim to make a greater contribution to the environment and society.

Glass
EVA
Silicon cell
Lead wire
“ALSOLAR®”
“Toybal Solar®”
Sealing material (Gus5010)
Aluminium frame

Silicon substrate

Anti-reflection coat
EVA
Ag electrode
Cell substrate
“ALSOLAR®”

Silicon nitride
Ag electrode

> Fields of applications
- Food and daily essentials
- Medicines and chemical products
- Industrial and construction materials
- Electronic equipment
Aluminium Manufacturing Platforms which fulfill their responsibilities.

The works are very serious about fulfilling their responsibilities to society, in addition, of course, to being serious about producing superior products.

Our superior quality and highly functional aluminium products, which claim some of the top shares in the world, are produced in our Works. We are very proud of each of them, and believe that they are at a top level globally, not only for their production technologies, but also for their processing development work and their ability to respond flexibly to requirements, etc. Ever since the foundation of this company, we have always taken safety as our top priority and have worked to improve productivity. We have also aimed to be a useful existence for the global environment and the regional society, by working to reduce the burden on the environment, and by promoting contributions to, and interaction with, the local societies. We will continue to meet these responsibilities in the future.

We respond to various foil production and processing requirements.

The foil business production system

Foil Products

Converted Foil Products

The whole works is maintained at clean-room standards for the production of packaging for pharmaceutical and feedstuff.
Responding to all customer needs for powder and paste products with our high-level processing technologies.

The paste business production system

**Pastes** | A specialized production centers for aluminium pastes which is one of the biggest in the world and has the highest quality.

The powder business production system

**Powders** | A specialized production centers equipped with the latest production facilities to respond to various requirements for powders.

(A) Gas atomization process

(B) Gas atomization and rotating disk method

Photographs showing the shape of the aluminium flakes
The Toyo Aluminium Group - making lives richer
With a consistent philosophy, the whole Group is working together to enhance the appeal of aluminium.

The use of our aluminium products is spreading in familiar products to our society.
The role of spreading them is undertaken by each production base and the Group companies. Based on Toyo Aluminium’s positive philosophy, the companies exploit their specialties to the full to deliver to human-oriented original products and special products throughout Japan.

Production bases in Japan

The Yao Works
The Yao Works is the largest aluminium foil rolling and processing plant in Japan, with ultra-thin rolling technology and a stringent quality control system. We also perform processing to laminate foils with other materials and also printing and calendering of the foil, etc. The Works produces a great variety of foils and packaging.

The Shinjo Works
Ever since the first Japanese production of aluminium foil in 1957, these specialist works have led the world’s aluminium foil business with one of the largest production capacities in the world and the highest quality. We have received high praise from customers around the world for our quality and for our global supply system, which is coordinated with bases in the U.S.A., France and China. We have raised our international competitiveness and brand power further by making the former Gusse Plant and former Hinase Plant parts of Shinjo Works from 2017.

The Hino Works
The Hino Works uses the aluminiumization process with our own unique technology to produce high precision (microwatucrate) aluminium powders with uniform particle size. It not only produces aluminium powders, but also has mass production equipment and pilot plants for speciality aluminium alloy powders and production equipment for high-purity aluminium nitride powders.

Major affiliated companies in Japan

Toyo Aluminium Ekco Products Co., Ltd.
K009001, K014001 certified
As a downstream department in the Toyo Aluminium Group, this company promotes a thorough emphasis on the customers and proposes new products which create new markets. It produces and sells familiar household products such as Tofu-cans and tins for ventilation fans, as well as plastic and paper packaging and aluminium foil containers for foodstuffs.

ALPHAMIC Co., Ltd.
K009001 certified
This company supplies unique aluminium foil and related products that brighten up kitchens with high quality for home and business use, with the goal of making lives safer, more convenient and more comfortable. We have shifted production bases overseas and formed strong organisations for research and development, manufacturing and quality control.

The Chiba Works
The Chiba Works has been manufacturing high quality plain foils and other industrial foil products that are attracting attention as functional materials for supporting leading-edge industries, such as Chiba Plant of Toyo Aluminium Ekco Products Co., Ltd. in the site has been manufacturing "funnel" which is a tap brand of household foil.

The Chigasaki Works
The Chigasaki Plant processes materials such as aluminium foils and films by various methods such as printing, calendering, dry laminating and tipping. Furthermore, it finishes products in the clean manufacturing environment in accordance with GMP (Good Manufacturing Practice) of USP1000 class.

The Shonan Yabata Works
In April 2014, Toyo Teflon Plant, Inc., and Yabata Factory of Tokai Aluminium Foil Co., Ltd., were merged into our works. It etches antenna cowlings and produces various aluminium foils.

The Shima Works
The Shima Works is a unique plant that produces aluminium foil and films by various methods such as printing, calendering, dry laminating and tipping. Furthermore, it finishes products in the clean manufacturing environment in accordance with GMP (Good Manufacturing Practice) of USP1000 class.

The Kanbara Works
Since it started mechanical aluminium foil rolling first time in Japan, it has been manufacturing aluminium foil for items such as foods, medical products and electronic parts based on its accumulated manufacturing technologies and know-how. Also, a processing factory has been laminating products such as Tofu-cans, packaging materials and food packing materials by laminating paper and water-based glue and aluminium foils together, printing and tip-up them.

Toyo Tokai Aluminium Hanbai K.K.
K009001, K017001, K027001 certified
This is a trading company selling the aluminium foils, pastes and powders of the Toya Aluminium group and also various other products from plastic containers, paper containers and packaging materials for tontons. The business is also extended globally, especially from the Singapore office and a subsidiary in Shanghai.

Toyo Aluminium Kosan K.K.
By utilising the experience and techniques of retirees from Toyo Aluminium, this company has received a top-class quality evaluation in Japan for its cutting narrow products. It also performs equipment maintenance and repair work, and assembly and installation work.

The Gumma Works
The Gumma Plant is the aluminium foil converting plant responsible for our comprehensive packaging, including packaging for pharmaceuticals and food products. The plant has an integrated manufacturing system to produce advanced processed products in processes including foil surface processing using embossing machines, lacerating machines, and foil and resin bonding, and also printing, and processing into bags using bag making machines.
An aluminium network making the world shine

Extending the business globally with a system of four key locations.

We believe that one of our missions is to contribute world-class aluminium technology and products to industry and societies across the globe. Working around 4 key business platforms in Japan, America, Europe and China, we offer our products, and we are also strategically proceeding with technical growth and sales and production base development.

**Major affiliated companies overseas**

**Toyal Europe S.A.S.U.**
Toyal Europe S.A.S.U. was established in 1982. It plays an important role as a production and marketing base for our aluminium paste and aluminium powders in the European market.

**Toyal Zhaoqing Co., Ltd.**
Toyal Zhaoqing Co., Ltd. was established in 2007. It is a production and sales base for aluminium paste and materials for solar cells in the rapidly expanding Chinese market. It plays an important role in our strategy for China.

**Hunan NingXiang JiWeiXin Metal Powder Co., Ltd.**
The Hunan NingXiang JiWeiXin Metal Powder Co., Ltd., an aluminium powder manufacturer and marketing company in China’s Hunan Province, was made a subsidiary in 2009.

**Sam-A Aluminium Co., Ltd.**
Sam-A Aluminium Co., Ltd. was established in 1970 as a joint venture between the Korean aluminium foil processing manufacturer Samjin Aluminium Co., Ltd., and Toyal Aluminium K.K. As a pioneer of Korea’s aluminium foil manufacturing industry, Sam-A Aluminium supplies high-quality products in a variety of fields, including foodstuff packaging, pharmaceuticals packaging and electronic equipment. It also manufactures and markets aluminium pastes.

**Toyal America, Inc.**
Toyal America, Inc. was established in 1987. The company, which is one of the largest such facilities in North America, is a production and sales base for the aluminium paste and aluminium powder businesses in the Americas.