Tanaka Chemical Corporation

The Future Envisioned by Tanaka Chemical Corporation

The development of cathode materials is infinitely expanding the power of batteries.

Research & Development

All Tanaka Chemical Corporation's products are essentially custom-made. For example, even with the same type of battery materials, the performance requirements vary depending on the intended application and each customer's unique battery design. Therefore, we optimize our products and produce precursors and cathode materials according to each customer's specifications in order to deliver materials that meet their specific needs. Our strength is that we are able to respond to a wide range of customer requests with our custom-made products.

Core Technology

- Particle Sphering Technology
- Multi-element Co-precipitation Technology
- Particle Size Control Technology
- Crystal Structure Control Technology

P.03

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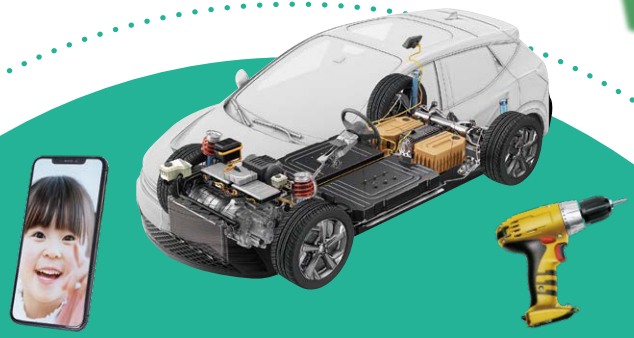
Tanaka Chemical Corporation has four core technologies that form the foundation of our research and development, as well as a wealth of manufacturing experience and achievements that we have carefully cultivated over many years of producing battery materials. Cathode (positive electrode) materials for rechargeable batteries that we have produced are used in a variety of everyday products, including electric vehicles and power tools. Our slogan, “Share ‘Plus’ Value with People and the Earth,” encompasses our message that we strive to enrich and make people's lives more comfortable in addition to our continuing efforts to contribute to global environmental conservation through our products.



Contribution through products

Tanaka Chemical Corporation has been a chemical manufacturing company for about 70 years since our establishment in 1957. In particular, we have been engaged in the development and manufacture of battery materials for more than 50 years, since 1973. We have been producing ternary cathode materials, one of our main products, for more than 20 years. With our long history as a well-established battery materials manufacturer, we firmly support the battery industry, not only in Japan but also around the world.

Precursor	Cathode material
Product Lineup	Product Lineup
Ternary Materials	Nickel hydroxide
Nickel-based materials	Cobalt coated nickel hydroxide
etc.	etc.

P.05

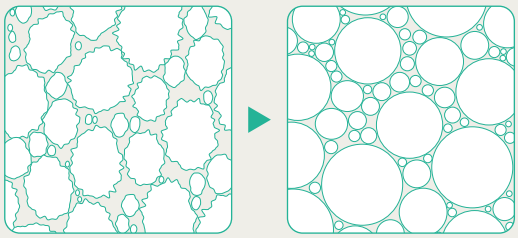
Tanaka Chemical Corporation has established four core technologies, along with a variety of proprietary technologies.

The cathode materials and precursors produced by Tanaka Chemical Corporation must be manufactured with precise control, mindful of the crystal structure at the atomic level and the particle shape at the nano–micron range. We manufacture products utilizing a variety of proprietary technologies and know-how, centered on four core technologies we have established over the course of our history.

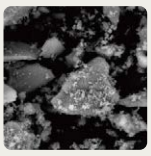
CORE TECHNOLOGY 01

Particle Sphering Technology

Particle shape control technology controls the shape of particles by controlling the reaction conditions in the reaction process. By utilizing this technology, Tanaka Chemical Corporation has succeeded in creating spherical particles, contributing to higher battery capacity and performance.

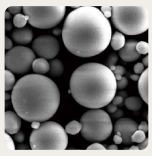


With this technology, we can...



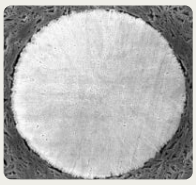
Irregularly shaped particles

Nickel hydroxide crystallized by neutralization reaction without any particular reaction control.



Create spherical particles

Nickel hydroxide crystallized by controlling the reaction using our proprietary expertise and technology.



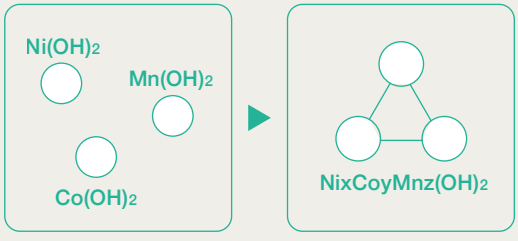
Cross-sectional SEM

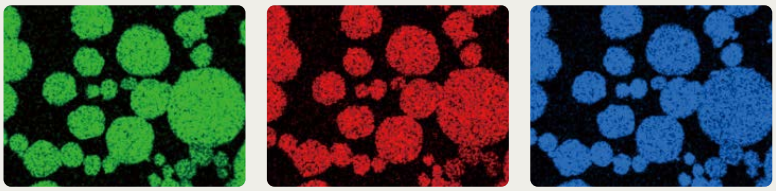
Cross-sectional images of spherical particles crystallized using this technology show that homogeneous, dense particles are formed, even internally. This indicates that each particle has increased density, due to the uniform crystallization reaction.

CORE TECHNOLOGY 02

Multi-element Co-precipitation Technology

With conventional manufacturing methods, multiple elements may appear to be uniformly mixed at first glance, but they may be unevenly distributed at the atomic level. Multi-element co-precipitation technology (or Co-precipitation) is a technique utilized to uniformly disperse and precipitate multiple elements inside particles.





Ni Co Mn

Measurement of the elemental distribution within products produced utilizing this Co-precipitation technology, shows that each contained element is uniformly distributed within a single particle and, additionally, each particle in the particle group has a similar elemental distribution. This means that each element is precipitated simultaneously when hydroxide particles are precipitated in the neutralization process. Our technical experience and expertise has enabled us to achieve this elemental distribution state by controlling the reaction conditions.

Surface Coating Technology

Based on this technology, Tanaka Chemical Corporation has coated the surface of nickel hydroxide particles with cobalt hydroxide to produce cobalt-coated nickel hydroxide, which is mainly used as a cathode material for nickel-metal hydride batteries. The resultant cobalt-coated nickel hydroxide enables smoother battery performance.

Nickel hydroxide

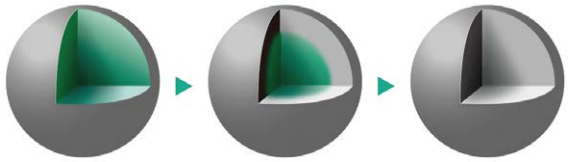
Surface of spherical particles of ordinary (i.e. not coated with cobalt hydroxide) nickel hydroxide

Cobalt-coated nickel hydroxide

Surface of spherical particles of nickel hydroxide coated with cobalt hydroxide

Chemical Oxidation Technology

Chemical oxidation technology is a technology utilized to create cathode materials in a charged state by chemically oxidizing nickel hydroxide to nickel oxyhydroxide.



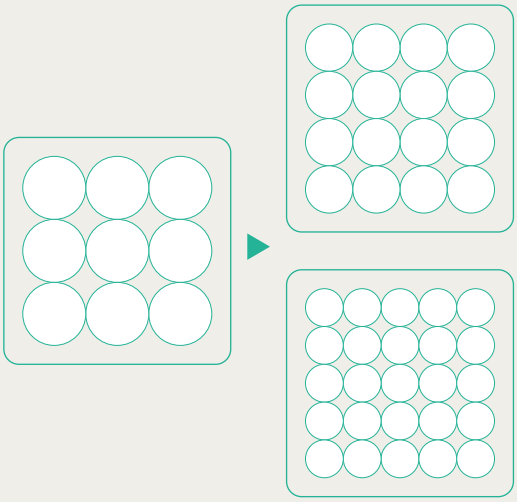
Oxidation only on the surface | **50% oxidation inside the particle** | **100% oxidation inside the particle**

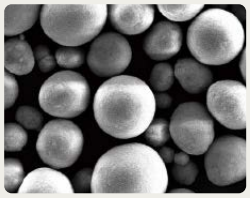
Our chemical oxidation technology allows us to freely control the degree of oxidation of each particle. This enables us to produce cathode materials with oxidation conditions that meet the various needs of our customers.

CORE TECHNOLOGY 03

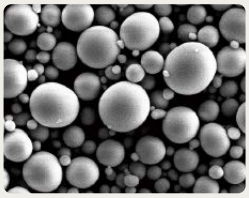
Particle Size Control Technology

Particle size control technology controls the size of particles by controlling the reaction conditions in the reaction process. We use this technology to produce particles of various diameters, contributing to higher battery capacity.

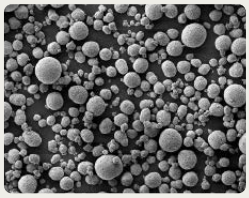




Particle size: Large



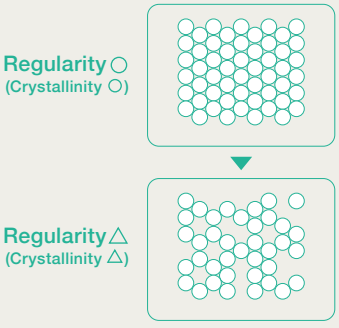
Particle size:Medium



Particle size: Small

CORE TECHNOLOGY 04

Crystal Structure Control Technology



The products developed and manufactured by Tanaka Chemical Corporation include nickel hydroxide and, generally, all metallic compounds. Even if these metallic compounds are the same (compounds with the same chemical formula), their properties can differ greatly due to differences in crystal structure. We have succeeded in changing the crystal structure of our products and producing materials with crystal structures tailored to various battery applications.

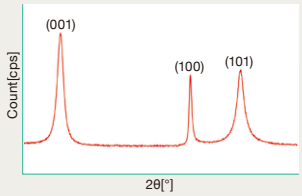


Fig.1 NiCoMn precursor X-ray diffraction pattern

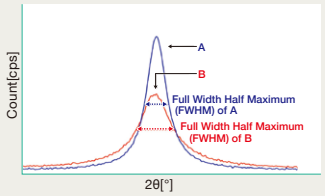
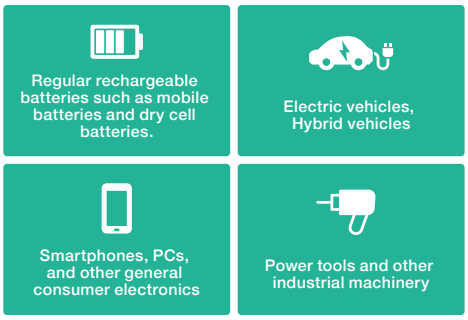


Fig.2 Comparison of NiCoMn precursors with different crystallinity

Figure 1 shows the powder X-ray diffraction pattern of Co and Mn coprecipitated nickel hydroxide, with no impurity peaks other than those characteristic of β-type nickel hydroxide, indicating that Co and Mn are doped at the atomic level to the matrix structure of nickel hydroxide.Figure 2 shows comparative data of two of our products with the same composition but with varying crystallinity. Since the products have the same composition, the position of the peak is the same, but the Full Width Half Maximum (FWHM, the spread of the peak at ½ height: indicated by the dotted arrows) is different between A and B. If the crystals are defect-free and arranged in a periodic pattern, the X-ray beam is diffracted at the same angle depending on the crystal planes of the sample, but if the periodicity of the crystals is low, the peak is broader and the FWHM is wider. This indicates that A is highly crystalline while B is less crystalline.

Tanaka Chemical Corporation has been manufacturing precursors and cathode materials for many years.

We produce battery materials for high-performance, rechargeable chemical batteries. These include “cathode materials” and “precursors” for cathode materials, which are recognized as being the principal ingredients with the greatest impact on battery performance. Our battery materials are used in a wide variety of end products, including rechargeable batteries, electric vehicles, smartphones and other consumer electronics, and industrial machinery. Although the required performance varies according to application, we respond to our customers with custom-made solutions, matching their needs and requests.



Precursors
(for lithium-ion batteries)

In lithium-ion batteries, to improve performance and reduce costs, the main raw material, nickel, is made into a composite compound (or ternary material) in which manganese and cobalt are partially replaced by nickel, aluminum and other materials are doped. The prepared solution is neutralized with an alkaline solution to produce a precipitate. Water is removed from the precipitate and the remaining, powdered form is the “precursor” (our product).

Products

Ternary materials

Ternary materials use three elements: nickel, cobalt, and manganese. Since the practical application of lithium-ion batteries, lithium cobalt oxide has been widely used as a cathode material. In recent years, however, demand for ternary materials has grown significantly in response to the need for lower costs associated with a large expansion in battery applications, such as mobile devices and electric vehicles. We have reduced the amount of expensive cobalt used, thereby achieving a reduction in cost, while optimizing the element ratios and powder physical properties to ensure the performance required for the intended application.

Nickel-based materials

Nickel-based materials, naturally, consist mainly of nickel. Since the commercialization of lithium-ion batteries, lithium cobalt oxide has been widely used as a cathode material, but in recent years, demand for nickel-based materials has grown significantly in response to the need for higher capacitance, mainly for electric vehicles. While nickel-based materials offer high capacitance, they are known to have low durability and thermal stability. Doping aluminum at the atomic level, allows us to ensure the cycle and safety performance required for electric vehicles.

Cathode materials
(for nickel-metal hydride batteries)

By adding an aqueous alkaline solution to a solution made by dissolving metals such as nickel (the main raw material) in acid, a neutralization reaction between the acid and alkali generates a precipitate.The precipitate formed by the neutralization reaction is then turned into a powder by removing water, resulting in a cathode material, which is our product. (Depending on the product, we also perform adjustment processing, such as applying surface coatings and others, to improve performance.)

Products

Nickel hydroxide

Nickel hydroxide is used as a cathode material in nickel-metal hydride batteries. When nickel-metal hydride batteries were first commercialized in Japan in 1990, their sales volume increased rapidly for use in portable electronic devices. However, they were eventually replaced by lithium-ion rechargeable batteries as mobile devices became thinner and lighter. More recently nickel-metal hydride batteries have been used mainly in hybrid vehicles and in a variety of other applications such as power tools and electric bicycles.

Cobalt coated nickel hydroxide

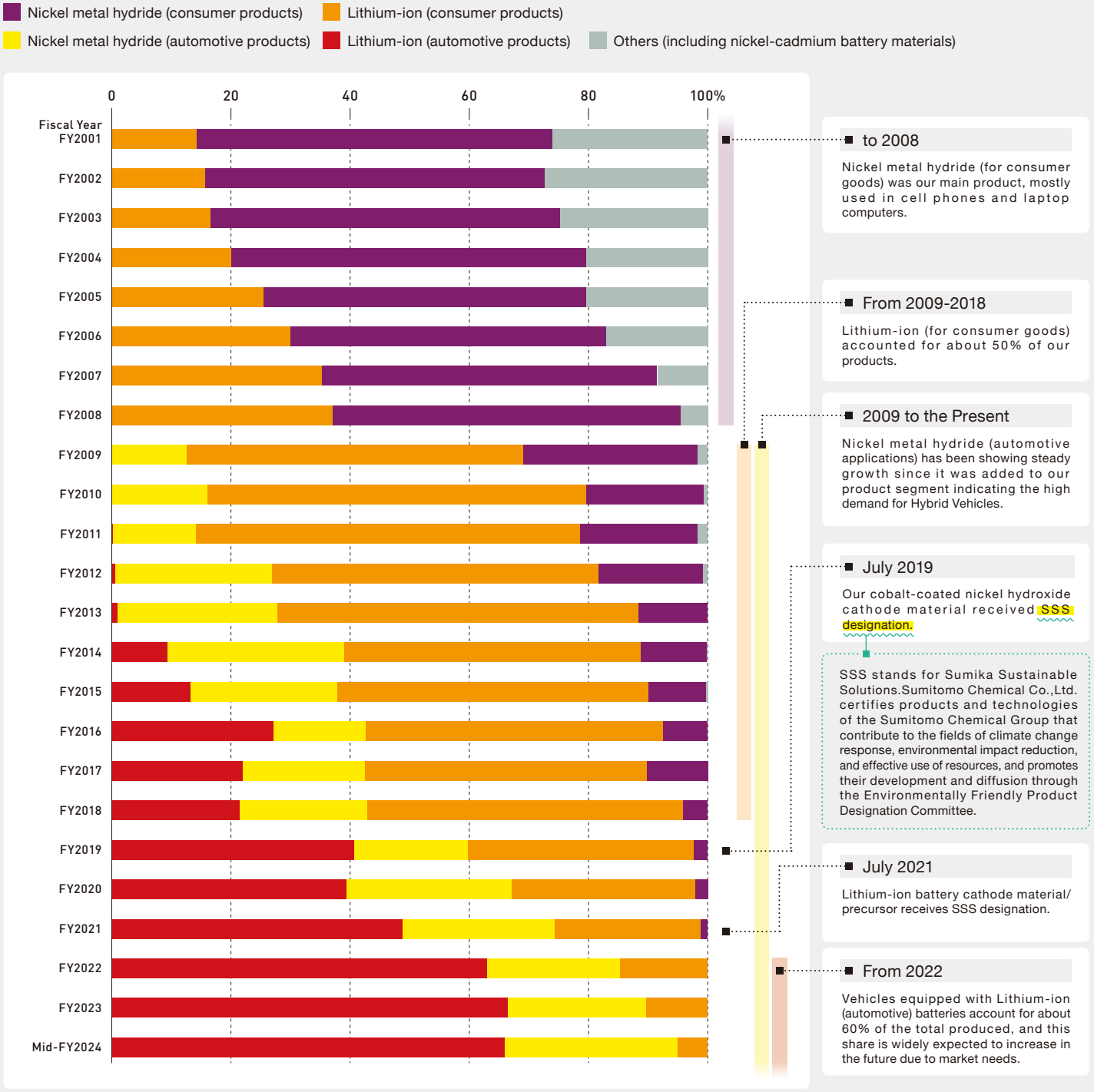
Some battery manufacturers use nickel hydroxide–the cathode material of nickel-metal hydride batteries–mixed with cobalt hydroxide as a conductive agent*. In order to improve conductivity further, we have developed nickel hydroxide with a surface coating of cobalt hydroxide. For details, please refer to “Surface Coating Technology” on page 04.

*Conductive agent: A battery material that enhances the conductivity of electrodes.

TOPICS

The History of Tanaka Chemical Corporation, trends in Product Segments

Tanaka Chemical Corporation has been involved in battery materials for about 50 years. Over the course of our history, the batteries have changed with the times, from nickel cadmium (Ni-Cd) batteries to nickel metal hydride batteries to lithium-ion batteries. In addition, our main products are now mainly for automotive applications, transitioning from when they were mainly used for consumer products. Compared to consumer products, the volume of batteries used in automotive applications is larger, and the volume of materials (our products) used in these applications is commensurately larger. The increasingly large distribution of our products means that we are contributing to the reduction of environmental burdens in many areas, and this contribution is rising with the transition to more environmentally-friendly automotive solutions, which feature our materials.



to 2008

Nickel metal hydride (for consumer goods) was our main product, mostly used in cell phones and laptop computers.

From 2009-2018

Lithium-ion (for consumer goods) accounted for about 50% of our products.

2009 to the Present

Nickel metal hydride (automotive applications) has been showing steady growth since it was added to our product segment indicating the high demand for Hybrid Vehicles.

July 2019

Our cobalt-coated nickel hydroxide cathode material received SSS designation.

SSS stands for Sumika Sustainable Solutions.Sumitomo Chemical Co.,Ltd. certifies products and technologies of the Sumitomo Chemical Group that contribute to the fields of climate change response, environmental impact reduction, and effective use of resources, and promotes their development and diffusion through the Environmentally Friendly Product Designation Committee.

July 2021

Lithium-ion battery cathode material/ precursor receives SSS designation.

From 2022

Vehicles equipped with Lithium-ion (automotive) batteries account for about 60% of the total produced, and this share is widely expected to increase in the future due to market needs.

POINT

We demonstrate flexibility in adapting our product segments to meet the rapidly changing needs of the market, responding with custom-made products. We contribute to the reduction of CO2 emissions by distributing exceptional battery materials in various fields. In addition, we have set the following goals for reducing environmental impact and are continuously working to achieve them.

Objective Reduce CO2 emissions in our company by 50% in FY2030 based on FY2013 CO2 emissions; achieve carbon neutrality in FY2050.

Initiatives

- Introduction of Green Power
- Fuel conversion to LNG
- Conversion of all lights and lamps in our facilities to LED

Corporate Vision

1 We, Tanaka Chemical Corporation, endeavor to solve global environmental issues and achieve a sustainable society by creating innovative new products based on our own technology derived from the development of positive electrode materials.

2 Each employee respects all others, enhancing their abilities and initiative, in a spirit of mutual cooperation, thus enabling the creation of a highly motivated corporate culture.

(Enacted in November 2019)

Corporate Data

Company name	Tanaka Chemical Corporation
Established	December 2, 1957
Capital	9.15 billion yen
Representative Director, Executive President	Tetsushi Kondo
Scope of business	1. Manufacture and sale of positive electrode materials for rechargeable batteries
	2. Manufacture and sale of inorganic chemical products
Stock exchange listing	Tokyo Securities Exchange(Standard Market)

tanaka-chem.co.jp

Office

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Tokyo Office

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Tokyo 100-6213 Japan

Head Office · Fukui Plant

History

1957	• Established Tanaka Chemical Corporation in Ikuno,Osaka with a capital of 1 million yen. • Commenced production of manganese carbonate (MnCO3) for ferrite at the Mukogawa Plant in Amagasaki, Hyogo.
1959	• Established the Ashiya Plant in Ashiya, Hyogo.
1973	• Commenced sale of nickel hydroxide.
1986	• Commenced production of spherical nickel hydroxide for Ni-Cd batteries.
1988	• Established the Fukui Plant. • Closed the Ashiya Plant.
1991	• Commenced production of spherical nickel hydroxide for Ni-MH batteries. • Relocated the head office to Fukui.
1995	• Opened the Osaka Office. • Commenced production of cobalt oxide for lithium-ion batteries.
1997	• Commenced production of high-capacity type nickel hydroxide(cobalt coated products)
1999	• Acquired ISO14001 certification. • Opened the Tokyo Office.
2000	• Counter stock registered at Japan Securities Dealers Association.
2002	• Acquired ISO9001 certification.
2003	• Commenced production of Ni/Mn/Co compound (ternary positive electrode material).
2004	• Stock listed on JASDAQ Securities Exchange.
2007	• Closed the Mukogawa Plant.
2009	• Obtained a patent concerning ternary positive electrode material in U.S.A.
2011	• Acquired Environmental Rating from the Development Bank of Japan.
2012	• Fukui Plant awarded the Chairman's Award from Japan Greenery Research and Development Center.Obtained a patent concerning ternary positive electrode material in Japan.
2016	• Became subsidiary of Sumitomo Chemical Co.,Ltd. through third party allocation of shares.
2022	• Transition to Standard Market, in accordance with restructuring of the Tokyo Stock Exchange.