PROTERIAL

News Release

May 23, 2023
Proterial, Ltd.
(Formerly Hitachi Metals, Ltd.)

Developed a technology that reduces CO_2 emissions during the production of cathode materials for lithium-ion batteries by more than 20%

Proterial, Ltd., ("Proterial") has developed a technology (“the developed technology") to manufacture cathode materials for lithium-ion batteries ("LIB[s]") without the previously required process of converting nickel to nickel hydroxide ($Ni(OH)_2$) to produce a precursor that is used as the starting material for the manufacture of cathode materials. The developed technology enables CO_2 emissions during the production of cathode materials to be reduced by over 20% compared to the manufacturing method based on the solid phase reaction method (announced in May 2022) that Proterial had developed (the "conventional manufacturing method"). By offering the developed technology to the battery industry as a solution for decarbonizing product lifecycles, Proterial will contribute to improving the environmental value of LIBs.

1. Background

As societies move towards decarbonization, the demand for LIBs—a crucial component of electric vehicles (EVs) which do not emit CO_2 when running—is expected to grow rapidly. However, LIB manufacturing accounts for a large proportion of CO_2 emissions in the EV manufacturing process, with the largest share of CO_2 coming from the starting material[*1] for cathode material (Figure 1). In particular, large amounts of CO_2 are emitted in the process of obtaining the precursor nickel hydroxide($Ni(OH)_2$) from nickel (Ni).

Furthermore, Europe plans to regulate CO_2 emissions for EVs not only when they are running, but also throughout their entire lifecycle. This will require the suppression of emissions during EV manufacturing, which includes the production of cathode material (Figure 2).

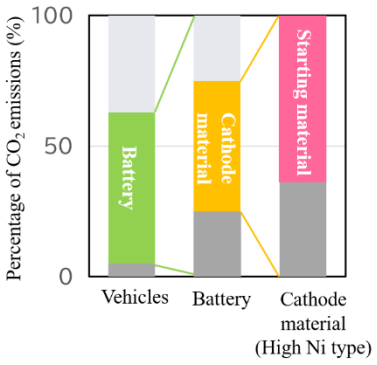

Figure 1: Percentage of CO_2 emissions[*2]

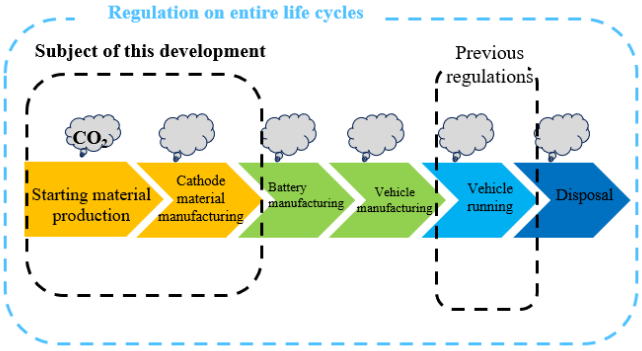

Figure 2: Trends in CO_2 emissions regulations

2. Outline

Aware that the number of starting material options can be increased by using the solid phase reaction method[*3]—which allows the use of materials other than water-soluble substances in the cathode material manufacturing process (announced in May 2022)—Proterial worked to develop a cathode material manufacturing technology that leads to reduced CO_2 emissions. As a result, Proterial has successfully developed a technology for producing cathode materials with comparable electrochemical properties (see table) without going through the process of producing the starting material where nickel sulfate ($NiSO_4$) is produced from metal nickel (Ni), and the precursor of nickel hydroxide($Ni(OH)_2$) is then produced from that (Figure 3). With the developed technology, Proterial has succeeded in reducing

Photo: Cathode material for LIBs

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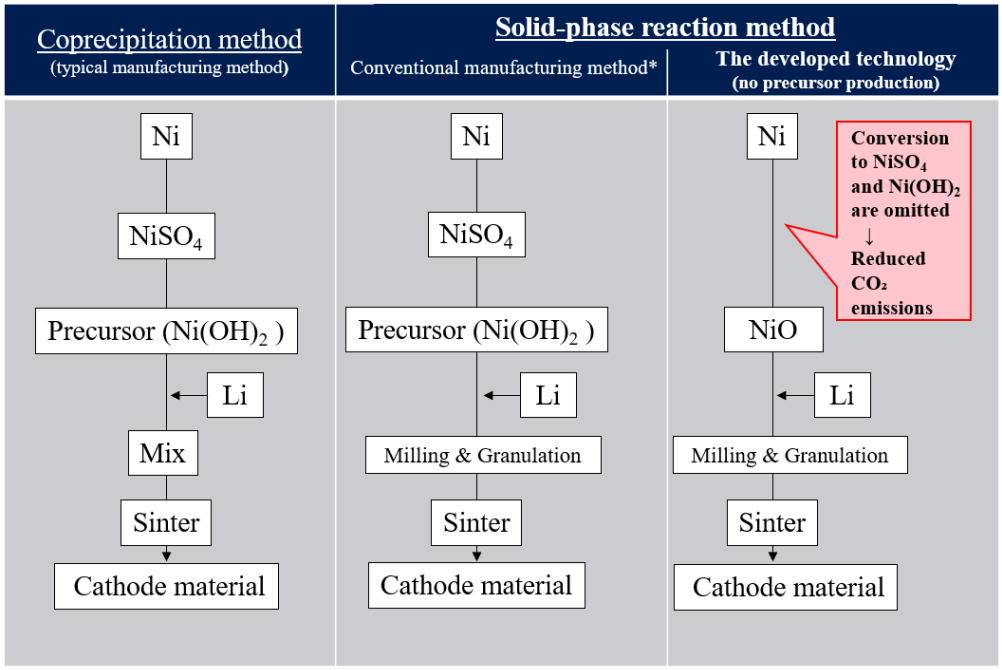
CO_2 emissions from the starting material by more than 30% compared to the conventional manufacturing method (Figure 4). This is equivalent to a 20% or greater reduction in CO_2 emissions over the entire cathode material manufacturing process[*4], including the production of starting materials.

Going forward, the developed technology will be applied as a decarbonization solution over product lifecycles for customers involved in the mass production of cathode materials and LIB development. This technology will be exhibited at The Battery Show Europe to be held in Stuttgart, Germany from May 23.



*May 19, 2022, Hitachi Metals, Ltd. News Release

Fig. 3: Manufacturing Method

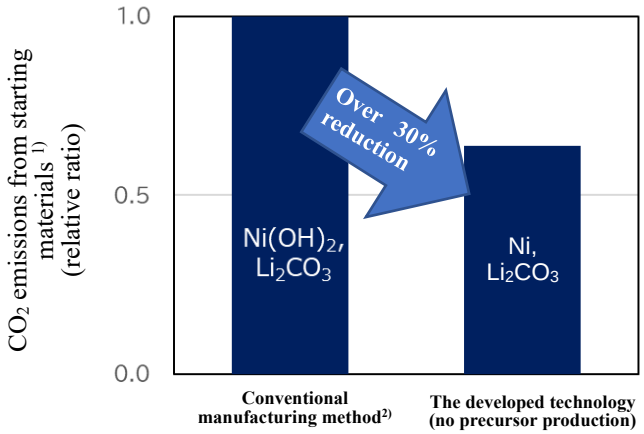
Table: Electrochemical Properties

Solid-phase reaction method	Discharge capacity (Ah/kg)	Capacity retention (%)
The developed technology (no precursor production)	192	90
Conventional manufacturing method	190	88

Composition: $LiNi_{0.85}Co_{0.03}(Mn_{(0.12-a)}X_a)O_2$

Discharge capacity measurement conditions: 4.3-2.5V, 0.2C (25°C), Anode: Li metal

Cycle conditions: 4.3-2.5V, 1C (25°C), Anode: Li metal



1) CO_2 emissions from raw materials used in $LiNiO_2$ production are estimated using 100% yield conditions.
Values from the following database and literature are used for CO_2 emissions intensity.
Ni, Li_2CO_3: LCI database IDEA version 2.3
$Ni(OH)_2$: Batteries 2019, 5, 48

2) May 19, 2022, Hitachi Metals, Ltd. News Release
Developed cathode material technology for lithium-ion batteries that reduces greenhouse gas emissions.

Fig. 4: CO_2 emissions from starting materials

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*1: Raw material that serves as the starting point for the first chemical reaction in the formation of a compound (the cathode material).

*2: Prepared by Proterial based on IEA Global EV Outlook 2020 and Sustainable Materials and Technologies 32 (2022) e00415.

*3: A manufacturing method based on powder metallurgy technology in which raw material powders containing the constituent elements lithium and metals are pulverized and mixed, granulated, and then sintered to cause them to react.
In contrast, the commonly used coprecipitation method does not involve pulverizing, mixing, or granulation, but instead chemically synthesizes metal hydroxide particles called precursors, which are then mixed with lithium raw material powder and sintered.

*4: The sum of CO_2 emissions from starting materials and CO_2 emissions from the cathode material manufacturing process.

■About the new trade name PROTERIAL

Hitachi Metals, Ltd. changed its trade name to Proterial, Ltd. on January 4, 2023.

PROTERIAL

"Proterial" reflects the essence of our corporate philosophy, which consists of three elements: Mission: "Make the best quality available to everyone;" Vision: "Leading sustainability by high performance;" and Values: "Unfaltering integrity" and "United by respect." It combines "pro-" with the word "material."

"Pro-" represents our "three pros":

- Professional — work that exceeds expectations
- Progressive — a spirit that keeps challenging
- Proactive —an enterprising attitude

"Material" refers to the high-performance materials that our original technologies produce and underpinned by the three pros. With our focus on solving customer issues and bringing new levels of value, we promise to contribute to the realization of a sustainable society through the products and services that embody our philosophy.

■Movie introducing "PROTERIAL"

https://youtu.be/Q0MKdTh3ofI

Click here for movie

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