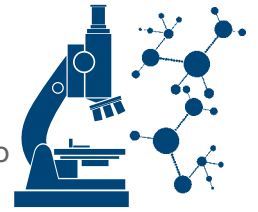


## The UBE Group's Innovation: New Environmental Technologies



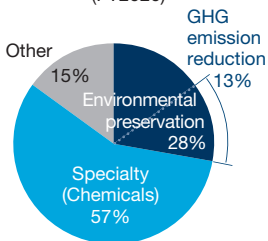
### R&D that Contributes to Create Businesses and Help Lower Environmental Impact

The UBE Group pursues R&D to create businesses that will be vital to its long-term growth. We are committed to cultivating technologies that help reduce GHG emissions and contribute to sustainable social growth.

### R&D

Breakdown of R&D Expenses by Research Theme

R&D expenses: ¥11.3 billion (FY2020)



The UBE Group's R&D program encompasses all four of its business domains—environment and energy, mobility, construction and infrastructure, and healthcare. From fiscal 2021, we will build on that foundation to undertake R&D that focuses on creating new businesses in five areas. These areas are construction and infrastructure, CO<sub>2</sub> and waste plastic utilization, energy management, nature sustainability, and life sciences.

We will increase success rates by enhancing the synthesis, catalyst, processing, and other technologies that we have amassed across the inorganic, organic, and polymer fields or have gained from collaborating with external entities. In choosing these five areas, we will maintain our specialization approach while becoming even more conscious of the need to tackle environmental issues. In energy management, for example, we aim to contribute to decarbonization by using energy-saving heat insulation and dissipation materials. On the nature sustainability front, we are exploring the use of natural raw materials and techniques to foster efficient plant and animal growth without harming biodiversity.

Addressing CO<sub>2</sub> emissions, waste plastics, and other long-term issues should also present new business opportunities. We will readily allocate resources and leverage projects that the New Energy and Industrial Technology Development Organization (NEDO) commissions to resolve such issues. Here, we will provide details of decarbonization projects and plastic recycling initiatives. We aim to reduce annual CO<sub>2</sub> emissions by up to 200,000 metric tons.

### NEDO Projects

#### CO<sub>2</sub> Utilization Projects Contributing to Decarbonization

##### Mineral Carbonation

##### R&D of an Accelerated Mineral Carbonation Process Utilizing Calcium in Industrial Wastes

- **Development team:** Ube Industries, Idemitsu Kosan Co., Ltd., JGC Group, Seikei University, and Tohoku University
- **Focus:** Use carbonate obtained from reactions between industrial waste with high calcium content and factory CO<sub>2</sub> emissions.
- **Progress:** The team is developing low-energy-consumption carbonate technology and applications for the resulting carbonate and by-products to build a process that is profitable and has a low environmental impact.

##### CO<sub>2</sub> Electrolysis

##### Integrated Electrochemical Systems for Scalable CO<sub>2</sub> Conversion to Chemical Feedstocks

- **Development team:** Ube Industries, University of Tokyo, Osaka University, RIKEN, Shimizu Corporation, Chiyoda Corporation, and Furukawa Electric Co., Ltd.
- **Focus:** Use renewable energy-derived electricity in electrolysis to convert CO<sub>2</sub> directly into useful chemical raw materials.
- **Progress:** The team is developing high-performance electrocatalysts and evaluating CO<sub>2</sub> electrolysis to build an electrolysis system that can efficiently and selectively convert CO<sub>2</sub> into useful chemical raw materials.

#### Waste Plastic Recycling

##### Multilayer Film Recycling

##### Developing Liquid-Phase Hybrid Recycling Technologies for Multilayer Plastic Films

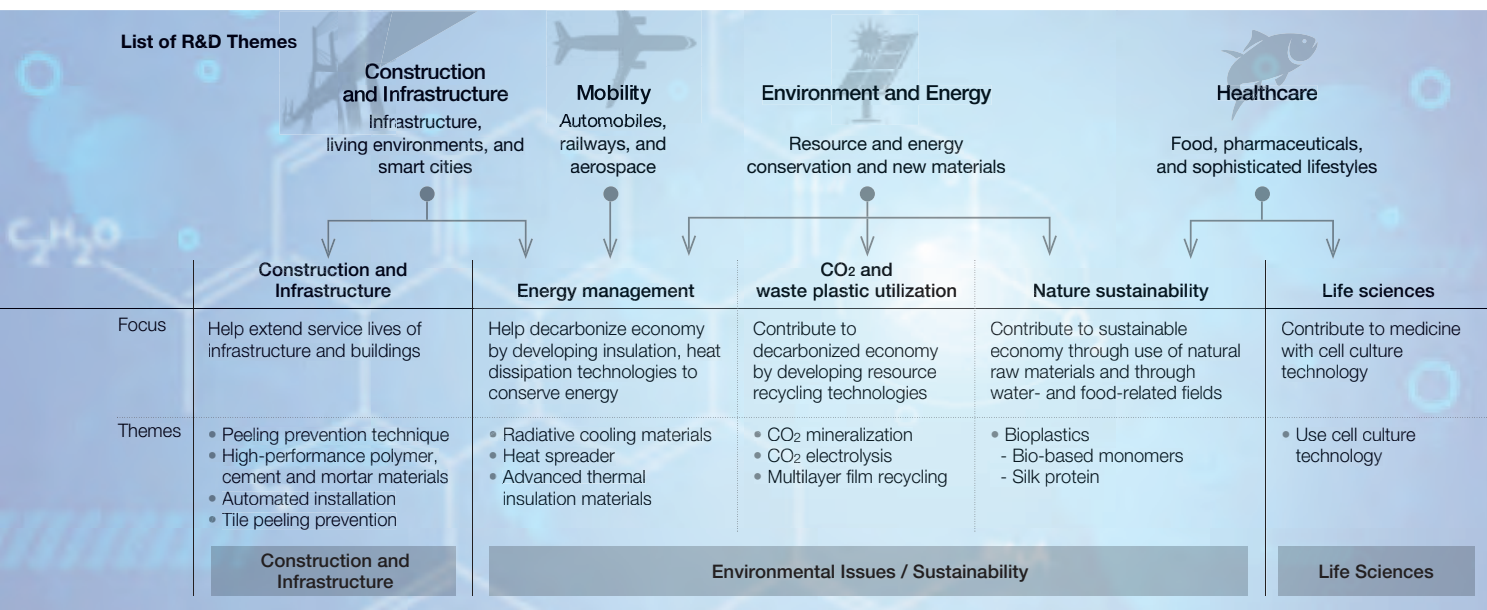
**Development team:** Ube Industries, Tohoku University, National Institute of Advanced Industrial Science and Technology, Keiwa Kogyo Co., Ltd, Tohzai Chemical



Masayoshi Ota

Senior Executive Officer, General Manager, Research & Development Div., with responsibility for development section and Intellectual Property Dept.

## Creating New Businesses and Lowering Environmental Impact through R&D



Industry Co., Ltd., Tosoh Corporation, Toppan Printing Co., Ltd., and Mitsubishi Engineering-Plastics Corporation

**Focus:** Treat multilayer (nylon–polyolefin) films at high temperatures with highly pressurized water to recycle decomposed nylon monomer and isolated polyolefins.

**Progress:** Attained target nylon monomer yield after decomposition as a result of initial nylon pellet assessment. Currently verifying optimal decomposition treatment for layer composition and crushing for multilayer films.

### Using Non-Fossil Raw Materials

#### Bio-Based Polymer

#### R&D of Data-Driven Integrated Biomanufacturing Management System

**Development team:** Ube Industries, National Institute of Advanced Industrial Science and Technology, and other entities

**Focus:** Obtain monomer through microbial biomass conversion.

**Progress:** Designed and constructed prototype microorganisms to produce monomer. From fiscal 2021, looking to shift to R&D using a data-driven integrated biomanufacturing management system (please see note).

*Note: This R&D support system accumulates, shares, and uses information obtained from technological development to drive the adoption of biomanufacturing technologies.*

#### Glossary

\*1 IP portfolios: Patents, copyrights, know-how, and other IP that corporations can use to formulate strategies and assess competitiveness

\*2 Open/close strategies: Management strategies that give companies competitive edges by making IP open or closed

## Intellectual Property

The UBE Group's initiatives to reinforce and optimally leverage intellectual property (IP) aim to enable us to create new businesses and bolster competitiveness, thereby helping to build and expand enterprise value.

We seek to maximize our enterprise and IP value by formulating IP strategies according to our business strategies and by implementing the plan-do-check-act (PDCA) cycle of IP strategy activities. Furthermore, to strengthen IP research and analysis capabilities, we are working to improve operational efficiency, including in R&D departments, by utilizing tools with AI functions and to utilize IP portfolios\*<sup>1</sup> and open/close strategies\*<sup>2</sup> while promoting IP activities that contribute to business revenue. At the same time, we are promoting global IP management as the UBE Group, and are advancing the sharing of activity policies and IP information with Group companies in Japan and overseas.

