

R&D

The UBE Group has positioned R&D as a sustainable growth driver. It is accordingly transitioning to specialty chemicals and tackling environmental issues.

R&D supports the UBE Group's growth to materialize its Vision for 2030. Our mission is to develop technologies in order to transition to specialty chemicals and tackle environmental issues.

Our distinctive products derive from proprietary manufacturing processes that we have amassed over the years. Our offerings are outcomes from creative ideas and innovative production techniques, and perform better than counterparts from rivals. We seek to contribute to society by delivering value that helps resolve social issues. We will accomplish this by nurturing such proprietary technologies while collaborating with other companies, universities, and research institutions to create new ones. We will keep developing technologies to overcome troubled todays and brighten tomorrows.

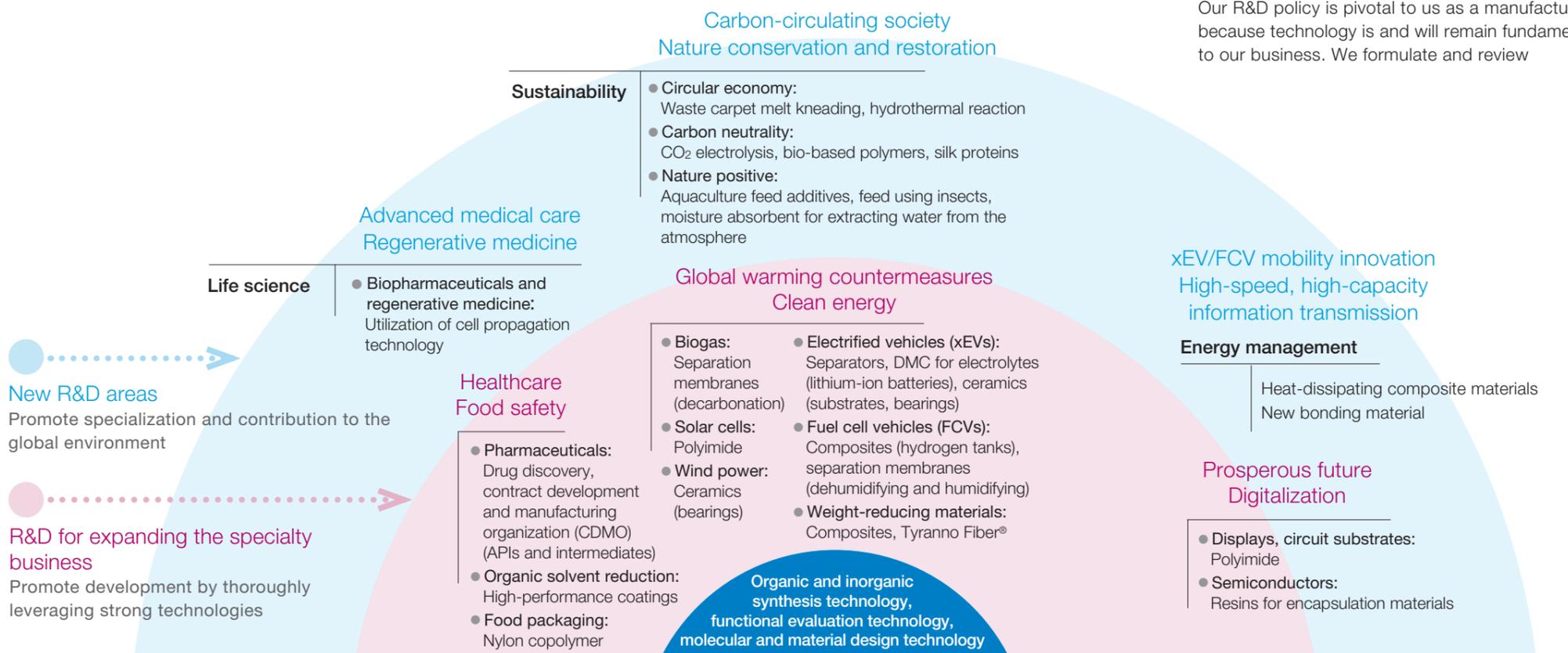


Masahiro Naiki
Executive Officer, General Manager,
Research & Development Div.,
with responsibility for development section
and Intellectual Property Dept.

R&D Policies and Structure

The UBE Group is striving to transform its business portfolio, which is vital for long-term growth, by leveraging R&D to create new businesses and resolve environmental issues at core domestic sites in Ube, Sakai, and Chiba and at business sites in Spain and Thailand. Two particular challenges are to focus on specialty businesses and become carbon neutral. We therefore engage with

prospective customers to offer unique solutions that integrate core technologies that have underpinned our chemicals business with the specific requirements of customers. We will provide materials matching social demands. We will do this by employing open innovation to build a technological edge, combining core internal technologies with external ones while digitizing processes as part of efforts to shorten R&D lead times.



Core Technologies Supporting Specialty Businesses

Distinctive technologies	Molecular and material design, functional evaluation, and information technologies
Core technologies	Organic and inorganic synthesis, engineering, polymerization, processing, catalyst, compounding, and quality and process control technologies

We will generate and deliver value that helps resolve social issues by drawing on proprietary technologies and innovative manufacturing capabilities that we have cultivated over our more than 120 years. Particular priorities are to use molecular and materials design technology based on customer requirements to design chemical structures and compositions, and functionally evaluate them. We will swiftly reflect feedback regarding these molecular and materials designs to provide brand new solutions to customers. Those customer requirements could include materials' heat resistance, strength, and recyclability or target biomolecule binding for pharmaceuticals.

Technology Strategy and Marketing Activities

Our R&D policy is pivotal to us as a manufacturer because technology is and will remain fundamental to our business. We formulate and review

technological strategies to meet contemporary needs through marketing to create new themes and marketing for products created by the Research & Development Div.

We have established three key research domains. The first is life sciences, where we will focus on healthcare. The second is energy management, spotlighting energy efficiency in the automotive and electrical and electronics areas. The third will be sustainability, encompassing the circular economy, carbon neutrality, and nature positive. We will create specific R&D themes based on forecasts.

We will take stock of the core technologies that make us competitive in providing new solutions to customers. We will refine and clarify our technology portfolio and acquire new core technologies for the Group.

Key Examples of Specialty Chemicals R&D

Inorganic Materials Development

UBE offers top-notch inorganic materials with performance properties that differentiate them competitively. They serve largely in vital high-end applications. We must specialize increasingly as social needs change so that we can cater to demand niches. Promptly identifying and addressing key challenges with advanced materials is vital to our ongoing success. Society has demanded urgent action in recent years to cut GHG emissions and shrink environmental footprints. This situation has accelerated efforts to electrify automobiles and heighten engine efficiencies in such fields as passenger aircraft, where electrification is extremely difficult.



UBE is well positioned to overcome the performance and quality hurdles of such mobility transitions. We will continue developing materials to tackle these challenges.

High-performance ceramics, for example, result from eliminating foreign matter and defects that impede reliability. They serve for long periods of time under harsh conditions, including high voltages, high-speed scraping, and high temperatures requiring thermal efficiency. We will overhaul the manufacturing technologies that are our strengths while monitoring social issues and collaborating with customers to help resolve those issues.

Drug Discovery Research and Pharmaceutical Product Development

In recent years, drug discovery research and pharmaceutical product development with diverse discovery platform technologies have driven the commercialization of small molecule drugs and antibody drugs and other molecules. These have included nucleic acid drugs and gene therapeutics for commercial pharmaceuticals.

It is against this backdrop that UBE is expanding its drug discovery targets. One focus is small molecule drugs, four of which we have developed and launched in collaboration with pharmaceuticals companies. Another is for disease areas with pressing clinical needs. We are, for example, working on modalities to fully leverage our conventional small molecule drug discovery experience, such as with antibody drug conjugates and proteolysis-targeting chimera.

Such a conjugate comprises three components. They are an antibody, a therapeutic payload, and a linker that attaches the payload to the antibody. The antibody transports the conjugate payload to diseased tissues. Because of its molecular design, the linker efficiently cleaves and releases the payload from the conjugate in the tissues to which the antibody carries it. We aim to build a business model in which we create new conjugates by harnessing our expertise in small molecule drug discovery to design, applying linker and payload combinations to antibody drugs offering exceptional safety and efficacy.

Proteolysis-targeting chimera combines two functions and similarly has three components. These are a target protein binding site, a binding site for enzymes that degrade proteins, and a linker. UBE looks to make it feasible to target proteins that have been beyond the capabilities of antibody drugs, as well as small molecule compounds. We have started exploring this area as new drug discovery modalities in which we can leverage our experience with small molecules.

We will also pursue R&D in new modalities to bolster our pipeline and swiftly bring offerings to market.



Heat-Dissipating Composite Materials

The information economy has improved lifestyles with rapid increases in the performances of electronic devices and communication technology speeds.



Heat-dissipating composite materials

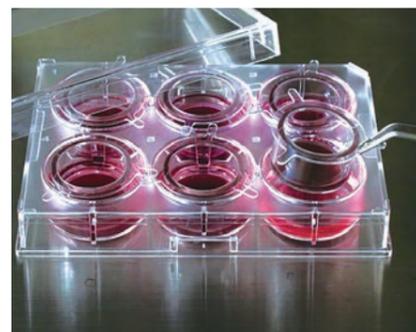
Work is progressing on advanced electric power networks in line with the renewable energy uptakes. Thermal heat issues are becoming more apparent as these technologies go mainstream and information and telecommunications equipment and power control devices become more sophisticated, integrated, and miniaturized.

One solution for these issues is a heat-dissipating composite material for energy management that UBE developed with Akane Co., Ltd., in Hiroshima. This material's thermal conductivity is three-fold that of aluminum nitride for heat-dissipating substrates and is roughly double that of copper. Its low thermal expansion coefficient could offer good bonding with advanced semiconductors. Another advantage is that its specific gravity is just one-third that of copper, which makes it possible for manufacturers to reduce the weight of their products. We are commercializing such composite materials based on the world-class thermal conductivity of our materials.

3D Cell Culture

Biopharmaceuticals come from the protein-producing capabilities of cells, microorganisms, and other living organisms. The emergence of biopharmaceuticals has fostered the development of drugs that can combat diseases that have been hard to treat. The quality of biopharmaceuticals is difficult to control, as they result from cell metabolisms that change in varying external environments. The slightest difference in manufacturing process conditions can drastically transform quality. These drugs are thus extremely expensive, which is a social issue.

UBE's proprietary 3D cell culture substrates overcome these issues because they stabilize long-term animal cell cultivation. We are researching and developing a proprietary biopharmaceuticals production process. We are working on a prototype cell culture kit to make exosomes and



Cell culture kit under development

therapeutic antibodies on small scales for testing among diverse industry players.

Progress in Developing CO₂ Capture and Utilization Technologies

CO₂ emissions are a global problem. It is necessary to innovate technologies that position these emissions as resources and tap them effectively.

Long-term studies are necessary to develop chemically stable CO₂ utilization technologies needed to become carbon neutral. UBE is collaborating with universities, research institutions, and other companies to develop such technologies.

Polycarbonate Diol Employing CO₂

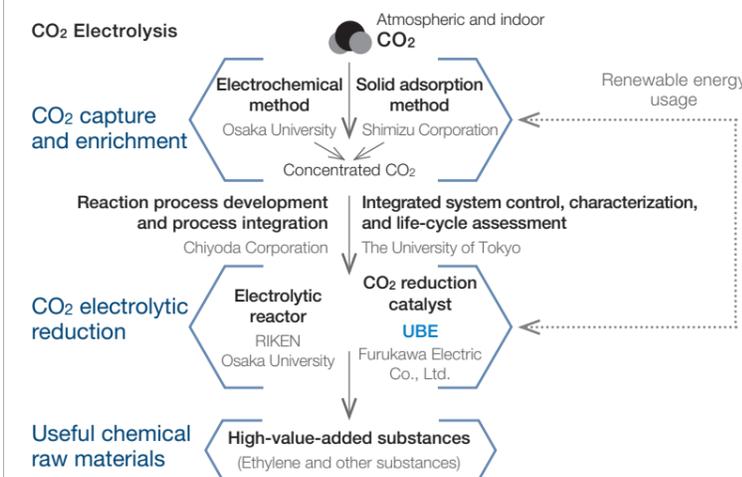
Polycarbonate diol is an essential intermediate for highly durable polyurethanes. UBE manufactures it in a multistep reaction process that uses carbon monoxide and other substances.

Osaka Metropolitan University, Nippon Steel Corporation, UBE, the University of Tokyo, Kyoto University, and Tohoku University have together embarked on an initiative to develop a one-step synthesis process for polycarbonate diol from CO₂. This effort is part of a project that the New Energy and Industrial Technology Development Organization (NEDO) commissioned. It is called Development of Technologies for Carbon Recycling and Next-Generation Thermal Power Generation/Carbon Recycling and Next Generation Thermal Power Generation Technology Promotion Project/Development of Common Basic Technology for Carbon Recycling Technology.

UBE will evaluate quality and suggest improvements to processes to pave the way to commercialization and help achieve carbon neutrality by 2050.

CO₂ Electrolysis

UBE is collaborating with industry, academic, and government bodies in a project in NEDO's Moonshot R&D Program, called Integrated Electrochemical Systems for Scalable CO₂ Conversion to Chemical Feedstocks. The project aims to develop an integrated electrochemical system that captures and enriches atmospheric emissions of diluted CO₂ with physical and chemical techniques, and then converts it to chemical feedstocks such as ethylene with renewable energy. We are creating electrode components that very efficiently reduce CO₂. We will continue working on technologies for real-world implementation.



Talent Development Initiatives

As well as R&D, creating new businesses entails understanding entire processes through commercialization. We are developing people who can set up new businesses by having them gain experience outside R&D, rotating them to other divisions and seconding them to other companies.

Employee message



I focused on materials research after joining UBE but wanted to be capable of creating new businesses. So, I requested a secondment to Refinerve Group, Inc. to learn about sales and business development. There, I interviewed and presented solutions to companies engaged in circular economy initiatives. Beyond these marketing activities, I also developed biomaterials businesses tapping unutilized resources.

Keisuke Kuroishi

Seconded to: Refinerve Group, Inc. Business Development Dept.
Now: Technology Marketing Group, Research & Development Div. of UBE Corporation

I will draw on that experience to create new environmentally friendly businesses at UBE.

Before secondment, I was keenly aware of how hard it would be to launch new businesses. I wanted to transfer to a venture capital firm to broaden my perspectives beyond in-house walls. My primary role is to start companies based on academic technology seeds. I am learning a lot about investment practices and about the philosophies that are essential to establish and grow new businesses and make them succeed. After returning to UBE, I look to apply this mindset to deliver results.

Yuji Hirai

Seconded to: Universal Materials Incubator Co., Ltd.



Intellectual Property

Basic Policy and Structure

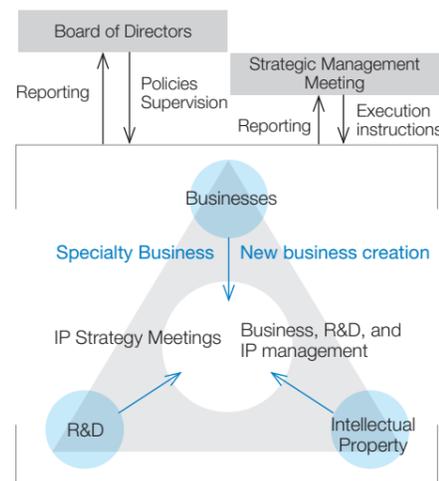
Basic Policy

We will gain a sustainable competitive edge in our specialty chemicals business by having our business, R&D, and IP departments collaborate closely in IP initiatives.

Structure

For the specialty business, these three departments hold IP strategy meetings. There, they discuss IP acquisitions and progress with investments in that area to ensure initiatives are on track.

Regular reports on overall IP activities go to the Strategic Management Meeting and the Board of Directors. They issue instructions on and supervise policies and execution approaches for IP efforts.



IP Initiatives under the Current Medium-Term Management Plan

Under UBE Vision 2030 Transformation — 1st Stage, our current medium-term management plan, our vision is to become a corporate group centered on specialty chemicals that contributes to the global environment, human health, and an enriched future society. We will help achieve our vision by taking several steps in the IP arena. One will be to disseminate useful information and make proposals by tapping patent search and other digital tools. Others will be to build a patent portfolio relating to specialty chemicals and environmentally friendly products and technologies, enhance Group IP governance, and bolster specialist talent. Details are as follows.

1. Build an IP Portfolio

It would be impossible to build a specialty chemicals business without IP. We are building a portfolio for that property that matches the nature of each specialty chemicals business. Specifically, we are amassing the patents we hold and the strategies we are using to reach business targets under our Vision for 2030. We will draw on IP information through patent maps*1 and IP landscapes*2 to identify new issues for resolution, new applications, and prospects for alliances with other companies.

For new inventions, our application review council assesses their essences and patentability

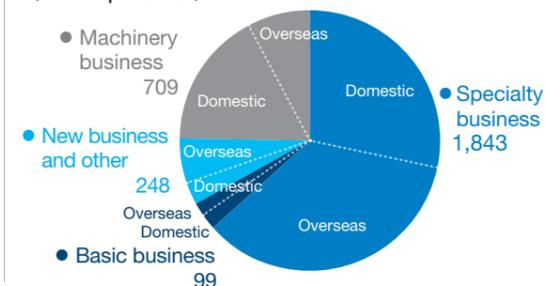
and determines the scope of rights in view of the supply chain and future implementation approaches. By deciding appropriately on whether to keep information open or closed, we seek to sufficiently safeguard our technical achievements, establish high barriers to entry through IP, and build a sustainable competitive edge for our businesses.

Utilization Strategy Examples

Product groups	Number of patents	Recent applications	Other company focuses	Responses
A	○	○		Current mainstays → Maintenance measures
B		○	○	Focus → Build portfolio
C			○	Licensing
D				Divest and sell

The R&D and Intellectual Property part of the Growth Strategies of Specialty Chemicals section on page 24 presents progress with specialty

Number of Registered Patents by Portfolio (As of April 2023)



Glossary

*1 A patent map is a visual representation from collecting, analyzing, processing, and organizing patent information into charts, graphs, and other visual information.

*2 IP landscape is an analysis of management and business information incorporating IP information in formulating management and business strategies and sharing results (including overviews of current situations and prospects) with management and business leaders.

chemicals R&D. We are pushing ahead with timely patent applications and rights acquisitions.

The number of registered patents is as shown on the left. We will increase the proportion of new and specialty chemicals patents.

2. Strengthening IP Landscape Efforts in R&D

Through R&D stages leading to commercialization, we research and analyze IP information and supply insights to the Research & Development Division about technological trends and competitor activities.

By tapping IP information from early R&D stages, we help develop themes, explore new businesses, and create collaborative partnerships.

3. Patent Clearance

We endeavor to respect the IP rights of other companies as we do our own. We accordingly do our utmost to conduct patent clearance searches and minimize business risks in existing businesses and at the commercialization stage in R&D.

4. Group IP Management

Collaboration between IP personnel at UBE Group companies enables us to handle the Group's inventions, supply IP information, and drive progress in IP management.

5. IP Human Resource Development

We foster a culture that emphasizes and respects IP by enhancing IP literacy.

We provide IP education by conducting Companywide programs that we tailor to new employee, general worker, and management levels. We also educate departmental information management personnel about trade secrets.

We look for specialists from the Intellectual Property Department to be proposal approach oriented to contribute extensively to R&D, business, and management by leveraging IP information and experience in applying for and obtaining patents.

We encourage employees to obtain external qualifications relating to IP, such as by becoming patent attorneys, acquiring IP skill certifications,

and becoming IP analysts. We had four qualified patent attorneys as of March 2023.

Brand Tagline Trademark Applications

UBE Industries, Ltd., renamed itself UBE Corporation in April 2022.

UBE has long maintained and managed trademark rights to the UBE logo. In view of the renaming, we developed the Transform Tomorrow Today tagline and applied for trademark registration in Japan and abroad for the combined trademark and tagline. We are in the process of acquiring these rights.



Inventor Incentives

In line with employee invention rules, we incentivize inventors upon applying for, registering, and implementing patent protections. At UBE Group R&D briefings, we honor inventors of patents that have contributed significantly to our business. Such recognition motivates inventors and encourages them to pursue further advances.

In fiscal 2022, we presented awards to inventors for patents in the polyimide and pharmaceuticals areas of our specialty businesses.



Message from outside counsel

I have served as representative for the UBE Group in its IP practice for more than 20 years. The Group holds many specialty chemicals patents. We endeavor to secure rights not only to fundamental technologies but also to such related technologies as manufacturing techniques and applications so that UBE can maintain its competitive edge in the specialty chemicals sector for many years to come.

I look forward to collaborating closely with internal teams and representatives to bolster UBE's IP network, thereby contributing to its progress as a specialty chemicals company.

Kazuya Senda

Representative Partner of Kisaragi Associates
The former Vice-President of Japanese Patent Attorneys Association
Daini Tokyo Bar Association Counselor at Law and Patent Attorney

