

# Research and Development

## Basic Policy and Features

Nissan Chemical considers research and development (R&D) as the source of growth, and continues to maintain one of the highest sales-to-R&D expenses ratio among chemical manufacturers. By Distributing management resources toward R&D, we create the seeds of new technologies and nurture them into businesses. We have transformed our business operations in response to social conditions. We have continued to take on the challenge of creating new technologies and businesses by nurturing the five core technologies of "Fine Organic Synthesis," "Functional Polymer Design," "Ultrafine Particle Control," "Biological Evaluation," and "Optical Control," and fusing them across fields. In Atelier2050, the long-term business plan that we launched in FY2022, we are challenging to create completely new technologies and products related to three growing businesses, Information & Communication, Life Science, and "Environment & Energy," by adding "Microbial Control" and "Information



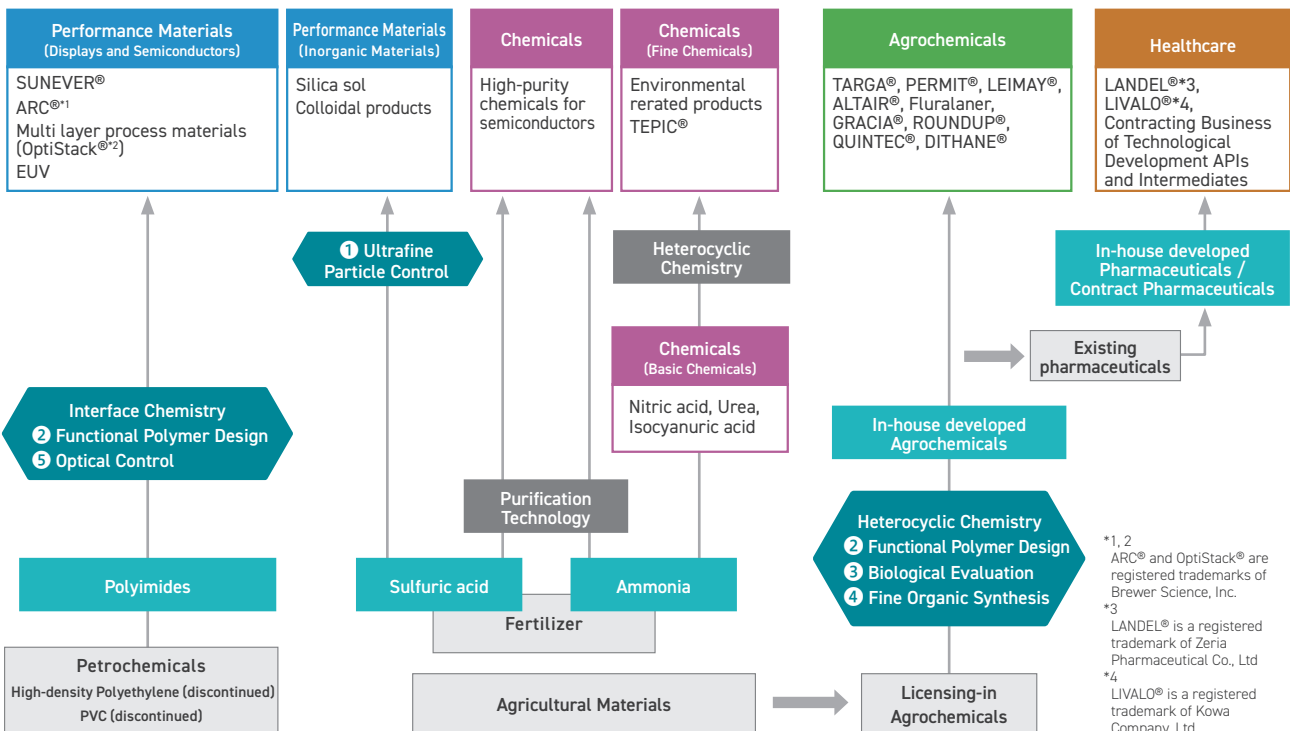
**ENDO Hideyuki**  
Managing Executive Officer CTO  
Head of Planning and Development Division

Science" to our existing core technologies.

We will continue to strengthen our R&D capabilities while promoting internal coordination and external research institutes, advance R&D on "Must-Have" products and services so that we can live up to our customers' voice, such as "it doesn't work without this product" and "this product is irreplaceable."

## Research and Development -Our Five Core Technologies-

= Five core technologies ① ~ ⑤



\*1, 2  
ARC® and OptiStack® are registered trademarks of Brewer Science, Inc.  
\*3  
LANDEL® is a registered trademark of Zeria Pharmaceutical Co., Ltd  
\*4  
LIVALO® is a registered trademark of Kowa Company, Ltd.

## New Core Technologies

### Microbial Control

By controlling microbiome in soil, in intestines, on skin, etc., we intend to expand our business to broader areas such as agrochemicals, healthcare, and environment. We aim to contribute to solving various social issues by commercializing medical materials, biostimulants, etc. in addition to microbial agrochemicals.

### Information Science

It is positioned as "technology that drives new value creation through simulation and data science." We will promote company-wide DX as well as materials informatics (MI) in research departments for the establishment of technology as a source of value creation in all business domains.

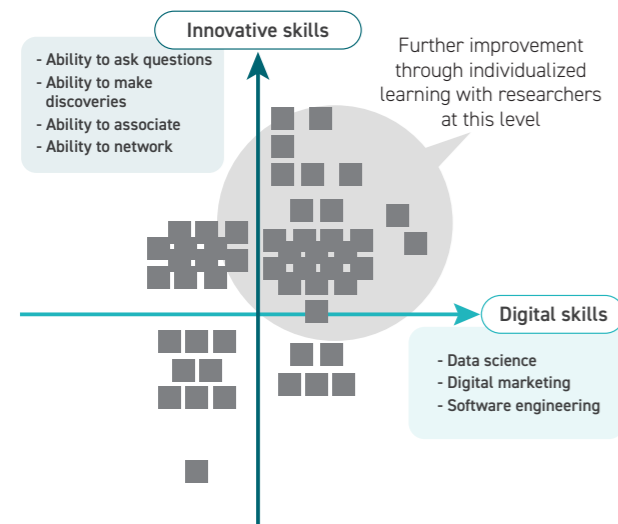
# Research and Development

## Improving Data Science Literacy of Researchers

As part of our efforts to make information science a new core technology, we have established learning opportunities, including e-learning, for the entire R&D department starting in FY2023, with the aim of improving the data science literacy of our researchers. This is an area of focus for many companies, but the unique feature of our approach is that we conduct periodic assessments as well as the overall learning to visualize our researchers' proficiency and ability in data science in numerical form. While it is sometimes difficult to evaluate the effectiveness of human resource development, we self-evaluate that we have been able to avoid this risk by introducing the assessment system.

The assessment is based on two axes: digital skills (skills in data science, digital marketing, software engineering, etc.) and innovative skills (ability to ask questions, discover, associate, network, etc.), and the second phase started in FY2024, focusing on the top-level researchers. In the second phase, we are working on an individualized program to ensure that participants focus on the digital skills needed in their assigned research themes and apply them to their daily research activities.

### Assessment results of the overall learning



## Theme Management of Research and Development

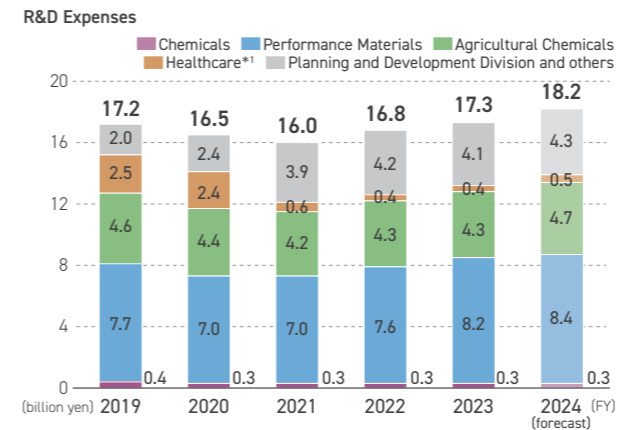
We are considering many R&D themes, mainly in the fields of performance materials and life sciences, and managing progress and gaps from targets for all themes. We conduct this management every six months, and evaluate and report on R&D progress from many angles, mainly on the technology axis, including the state of technological progress, technical goals for the next six months, schedules for commercialization, intellectual property information, and the status of manpower allocation. The head of each research laboratory and supervising officer of each research field participate in the debriefing sessions, and for R&D themes that are behind schedule, they discuss the background to the delays and ways to make up for them. When it is necessary to discuss theme interruptions, we make our decision taking into account whether there are recovery strategies, changes in market conditions, and business models for each theme area.

On the other hand, at the debriefing sessions, newly initiated R&D themes are also shared, allowing each research and development department to recognize newly started themes and to exchange effective ideas for advancing research.

## R&D Expenses

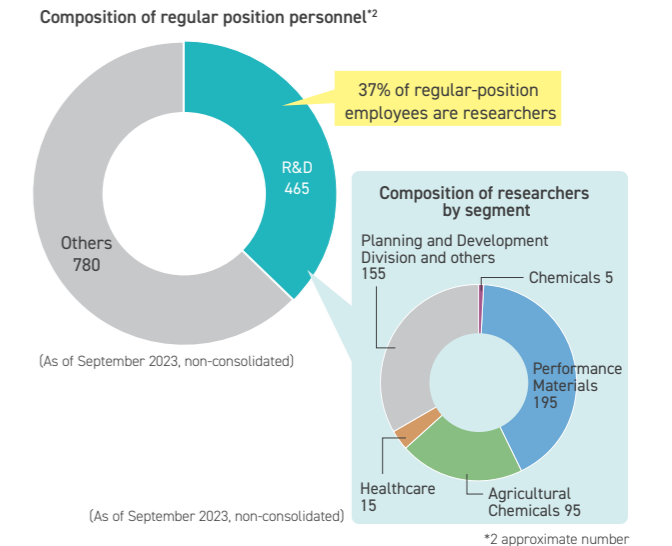
We consider R&D is the source of growth, and have intensively invested our management resources in R&D.

Over the last five years, R&D expenses have totaled 83.8 billion yen. The R&D expenses in Performance Materials and



\*1 The figures of FY2019-2020 are the former Pharmaceuticals Division.

Life Science that combined with Agricultural Chemicals and Healthcare account for about 40% each. In addition, about 40% of employees of regular position are allocated as researchers.

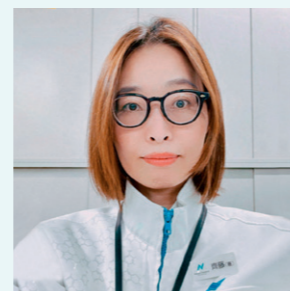


\*2 approximate number

## Voices of Researchers

### The forefront of drug discovery research using data science

**SAITO Noriko**  
Chemical Research Laboratories  
Pharmaceutical Research Dept.

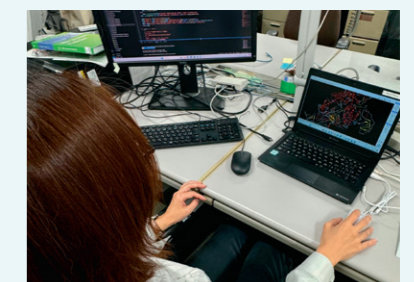


Our department has been engaged in "improving the efficiency of drug discovery research by predicting activity and toxicity using informatics and AI" and "arranging in-house drug discovery research databases necessary for building prediction models and utilizing AI." Starting in FY2023, we are also working on "acquisition of nucleic acid molecular simulation technology," "arrange of research databases in the life science field," which will expand into various modalities including nucleic acids and peptides, and the agrochemical field, and "utilization

of the supercomputer Fugaku." Researchers who are skilled in synthetic experiments are now working on data science and have the digital literacy to code and develop methods themselves, which allows them to quickly apply data science methods to drug discovery research and improve their methods themselves.

In the future, we intend to maximize our existing core technologies such as "fine organic synthesis" and "functional polymer design" by streamlining non-core operations, improving the computer environment, and introducing ro-

bots for further automation, in order to provide products required by the market.



### What I have learned in my dual role as a researcher and sales representative for oil and gas (O&G) development

**MURAKAMI Satoru**  
Materials Research Laboratories  
Inorganic Materials Research Dept.



For about five years, until April 2024, I worked on development in the O&G field, concurrently serving in the Inorganic Materials Research Dept. and the Inorganic Materials Sales Dept. In the early stages of development, we were not able to have in-depth discussions with customers due to our lack of knowledge of O&G, but our team worked as one and were able to advance the development of water shut-off agent and EOR (enhanced oil recovery) chemicals to tests at oil fields in Japan and overseas. In addition, we have launched a new CCS theme in line with the accelerating global decarbonization, and are promoting the development of environmentally friend-

ly technologies. During my time in this dual role, I was able to gain valuable experience by being involved in the entire development process, including new customer development, problem identification, development policy formulation, material development, introduction of materials through presentations at academic conferences and exhibitions, raw material procurement, scale-up manufacturing, and delivery. Building relationships with customers is especially important, and there have been occasions when we have made significant progress in development through dialogue with key persons and the information they have provided. I have been in charge of

O&G and polishing research since April 2024, and I aim to increase real demand in the O&G field and expand real demand for polishing applications while maintaining close cooperation with customers.



# Intellectual Property

Our Group regards research and development (R&D) and the intellectual property it results in as “the foundation of business” and “the source of growth.”

## Basic Policy and Features

Nissan Chemical carries out its intellectual property activities based on the “Management Policy of Industrial Property” formulated in 1997, with the three following pillars: “prompt acquisition of intellectual property rights,” “appropriate utilization of intellectual property,” and “intellectual property risk management.” In recent years, “advanced utilization of intellectual property and non- intellectual property information (promotion of IP landscape)” and “intellectual property contracts and external relations support” have also become important activities, and the Intellectual Property Department leads these initiatives as a “good navigator of R&D and business development.”

The biggest feature of our intellectual property activities is that “business divisions, R&D departments, and Intellectual Property Department unite seamlessly.” This feature has been achieved through our emphasis on R&D, with 70% of new employees and 40% of regular positions being researchers. Outside of the Intellectual Property Department, business divisions and planning departments at the Head Office also include many employees with experience in research, and a large number of personnel familiar with both R&D and intellectual property leads to lively discussions on patents and measures regarding other companies’ rights. Moreover, intellectual property liaisons are established in each division to engage in intellectual property activities in collaboration with the Intellectual Property Department.

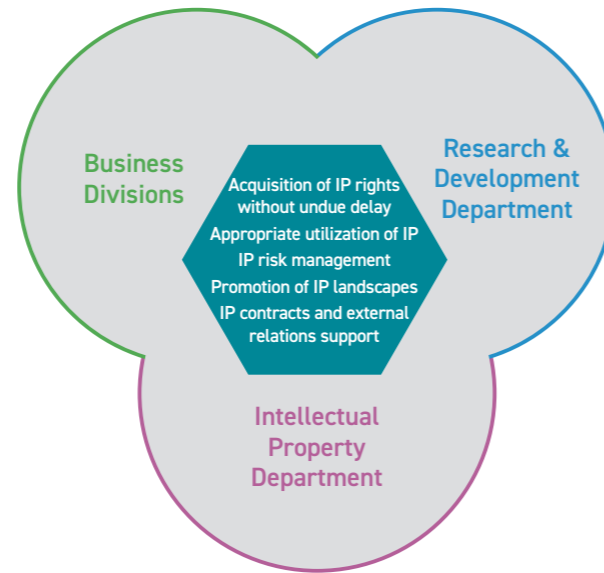
“Intellectual property conference” held in the business divisions and planning departments of the Head Office, all laboratories and plants are another our characteristic activity. By sharing intellectual property strategies as well as internal and external issues related to intellectual property at the conference, we are working to improve company-wide intellectual property literacy and cultivate and raise the intellectual property mindset.

To further accelerate these intellectual property activities, we revised the Intellectual Property Department system in April 2024 and newly established the Information Strategy Office and IP Development Office with the aim of promoting strategic use of intellectual property and to further strengthening and integrated management of inter-operational collaboration related to IP operations.

In this way, we seamlessly implement three-pronged intellectual property activities through business divisions, R&D departments and the Intellectual Property Department, and possesses a high level of intellectual property literacy as a whole company.

### Seamless intellectual property activities

One concrete example of such seamless intellectual property activities is the “patent meeting” attended by core members of R&D and business. At Nissan Chemical, these patent meetings are opportunities to comprehensively discuss each strategy of business, R&D, and intellectual property, which is reflected in each policy and generates speed and competitiveness.



In order to achieve this, it is necessary for people involved in business and R&D to be able to quickly access intellectual property information, and the Intellectual Property Department is responsible for developing the platform for this. As an example, we have established an environment that allows company-wide use of patent search tools and regularly hold educational training sessions on how to use them. Also, in the hypothesis verification-based training (training before promotion, P32), the Intellectual Property Department provides guidance on skills to collect essential IP information and provides information through IP analysis and IP landscape, thereby supporting further improvement of the IP mindset of each employee.

While we promote patent applications as a result of R&D, we review the necessity of various post-application procedures (application to foreign countries, entry of PCT applications into the national phase, requests for examination, etc.) in light of the business situation through discussions between the business department, the R&D department, and the Intellectual Property Department, and obtain rights appropriately. On the other hand, we conduct periodic “inventories” of registered patents. We review not only patents directly related to the business being conducted, but also the effectiveness of patents that constitute a barrier to entry against competitors, to determine whether to maintain or abandon their registration. Thus, through appropriate intellectual property management, we are building a valuable patent portfolio that can contribute to the expansion of our business.

As a characteristic of our intellectual property activities in each field, we are promoting the strategic establishment of a patent portfolio ahead of our competitors in order to obtain a high market share in the field of performance materials.

On the other hand, in the agrochemical and pharmaceutical

fields, we are implementing intellectual property strategy that “global” and “can win in the case of litigations.” We have experienced disputes in many countries and, if necessary, will directly eliminate other companies by litigating.

### Aggressive Acquisition of Intellectual Property Rights

As shown in the trend in the number of patents owned (p.12), we are actively acquiring patent rights both in Japan and overseas.

Our overseas percentage of patents owned ([number of overseas patents owned / total number of patents owned x 100] %) is approximately 70%, which is the highest among major domestic chemical manufacturers. This is the result of our promotion of a patent application strategy to ensure that we can conduct our business with confidence both domestically and internationally.

In the same way, compared to thirty major domestic chemical manufacturer, the number of patents owned as a percentage of sales ranks first, and the number of patents owned as a percentage of R&D expenditures ranks fourth. Excluding the agricultural chemicals and pharmaceuticals fields where the number of patents owned is low relative to R&D expenses, the number of patents owned materials field is approximately double

the average of major domestic chemical manufacturer in terms of R&D expenses.

**Our overseas percentage of patents owned and the number of patents owned compared to thirty major domestic chemical manufacturer<sup>1</sup>**  
(Commercial databases used)

|   | 2022             |  | 2023             |  |
|---|------------------|--|------------------|--|
|   | Nissan Chemical  | Average of 30 companies in the chemical industry | Nissan Chemical  | Average of 30 companies in the chemical industry |
| Overseas percentage of patents owned (%)                                    | 69.8 (1)         | 50.1   | 69.4 (1)         | 49.2   |
| Number of patents owned / Sales (cases/100 million yen)                     | 2.7 (2)          | 1.1  | 2.7 (1)          | 1.0  |
| Number of patents owned / R&D expenses <sup>2</sup> (cases/100 million yen) | 35.1 (5)<br>59.7 | 26.9   | 36.3 (4)<br>59.7 | 26.2   |

<sup>1</sup> Figures in parentheses indicate our ranking among major domestic chemical manufacturer  
<sup>2</sup> Figures in the lower row are calculated only for the Performance Materials field

## Examples of Intellectual Property Activities

### Construction of a patent portfolio for photo-alignment materials for IPS mode liquid crystal (LC)

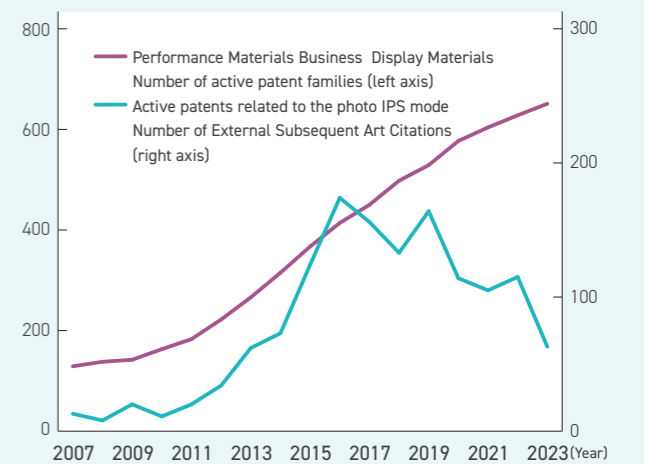
Nissan Chemical currently holds a high share of the global market for photo-alignment materials for IPS mode LC used in LCD panels, with more than 95% of the global market. Around 2010, when LCD panel manufacturing technology was switching from rubbing IPS to photo IPS, we discovered high-performance photo-alignment materials for IPS mode LC ahead of our competitors and intensively applied for many patents. As a result, we have succeeded in securing an extremely high business advantage.

More specifically, we have achieved many patent applications in a short period of time by formulating patent application strategies based on business strategies after close discussions between business department, R&D department, and the Intellectual Property Department at patent conferences led by the Intellectual Property Department. In addition, we were able to build a robust patent portfolio by conducting research and patent applications based on a research plan designed to put up barriers to entry against competitors in cooperation with our R&D department.

As shown in the graph, the total number of External Subsequent Art Citations of the active patent group related to photo-alignment materials for IPS mode LC increased rapidly from 2010 to 2016, indicating that while the number of patent applications from competitors in this field increased, our patent portfolio demonstrated a strong restraining and exclusivity effect in the examination process of those applications. On the other hand, we speculate that the trend of

a decrease in the total number of External Subsequent Art Citations since 2017 is an indication that our competitors are developing materials by circumventing our patent portfolio, given the continued dominance of our business since 2017.

In recent years, we have been supporting our current LCD alignment materials business through continuous intellectual property activities, such as patent applications for improved and peripheral inventions and the elimination of intellectual property risks.



**Trends in the number of External Subsequent Art Citations in valid patents related to photo-alignment materials for IPS mode LC**