

Intellectual Capital

Initiatives for Material Issues

In its Medium-term Management Plan, Idemitsu has outlined expansion of growth businesses, creation of next-generation businesses, and harmony with the global environment and society as priority topics. To promote the creation of new business in particular, we established the Next Generation Business Department, which promotes business development that addresses social issues and meets customer needs, in November 2019; the Digital Innovation Department, which promotes the use of digital technologies, in January 2020; and the Innovation Strategy Planning Department, which promotes technology-driven business development, in April 2020. We have crafted strategies that consolidate company-wide technologies and actively draw on external technologies with the aim of quickly achieving the creation of new businesses with an eye toward changes in society, diversifying customer needs, and decreasing environmental burden.

Technological innovation is indispensable to achieving the goals of the Paris Agreement, which is an international framework related to climate change. The Idemitsu Group is using the technological development capabilities it has developed over many years of operations to continue generating innovation that will help solve various social issues, including climate change.

R&D Investment Record

We conduct R&D related to petroleum, functional materials, and resources as well as new business creation. Under our R&D system, our departments pursue R&D activities in close mutual cooperation.

| ■ FY2019 R&D Investment Record | | (Millions of yen) |
|----------------------------------|----------------------------|-------------------|
| R&D expenses | | 19,436 |
| | Petroleum | 2,356 |
| | Basic Chemicals | 0 |
| R&D expenses by Business Segment | Functional Materials | 12,166 |
| | Power and Renewable Energy | 538 |
| | Resources | 232 |
| | Others | 4,142 |

Promotion of Open Innovation

To strengthen and expand the functional materials business and create next-generation businesses, we promote open innovation that actively leverages external knowledge.

1. We participate in funds that are run by material-oriented venture capital interests and strive to discover technology seeds owned by ventures and startups in Japan and overseas.
2. In April 2020, we established the new Innovation Strategy Planning Department with the mission of consolidating company-wide technologies and accelerating and promoting external cooperation. Within the department, we established the Open Innovation Promotion Group.
3. In April 2020, we opened the "Idemitsu Kosan Next Generation Material Collaborative Research Center" at the Tokyo Institute of Technology. This research center is working to create next-generation materials and develop human resources by promoting large-scale comprehensive collaborative research centered on macro molecules and composite materials.

Utilization of Intellectual Property

We have established the Intellectual Property Department to supervise intellectual property. The Intellectual Property Department supports our business development and activities to increase the brand value of our products by collaborating with business and R&D departments to apply for, secure, maintain and utilize intellectual property rights, such as patents and trademarks.

Initiatives to Utilize Intellectual Property

Promotion of Intellectual Property Activity Plans

We use the PDCA cycle to formulate IP Activity Plans based on the directives of the Intellectual Property Strategy Council headed by the general managers of each department. The departments, research laboratories, and the Intellectual Property Department work together to promote priority issues. We have also introduced the "Unit Structure," which efficiently solves problems in a wide range of business fields, from petroleum to functional materials, in accordance with the characteristics and strategies of each business. By doing so, each unit can smoothly carry out intellectual property activities such as patent search and analysis, patent prosecution, negotiations, planning, and administration.

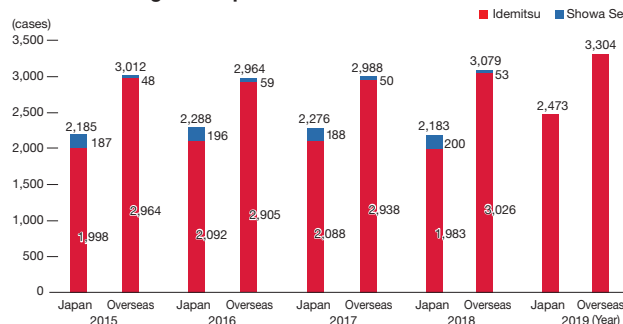
In the petroleum field, we have entered into a cross-licensing agreement and are working to strengthen our competitiveness, to this end reducing costs by making available patents from both parties. In the lubricants field, we command a large share of the global market for refrigerating machine oil, which is one of our strengths, and we have established global patent portfolios.

Because market growth is expected in the OLED business, the core field of the electronic materials business, we have entered into alliance agreements with companies in Japan and overseas that hold useful patents related to OLED materials, enabling the mutual use of patents in specific fields. Through these and other measures, we are working to create and expand businesses while expanding the areas in which development is possible.

Exercising Intellectual Property Rights

Intellectual property rights are being exercised with increasing frequency in response to the diversification of business activities, from licensing to the pursuit of alliances and mergers and acquisitions. We established a specialized negotiations team within the Intellectual Property Department to support its various business segments by handling the negotiation and signing of technology contracts with partners as well as performing due diligence.

■ Number of registered patents held



R&D Structure

Our R&D system is composed of Advanced Technology Research Laboratories, which supervise corporate R&D, and research laboratories in each department. Each of them carries out specialized development. In addition, we established the Research & Develop-

ment Committee as a company-wide organization to not only examine the direction of research and development, strategies, and issues throughout the organization, but also to deepen cooperation among laboratories and to strengthen technological capabilities.

| Research field | Name of laboratory | Japan | Overseas | Outline of Initiatives |
|--|--|-------|----------|--|
| Corporate R&D | Environment & Energy Research Laboratory | ● | | ■ Development of technologies to reduce GHGs and recycle resources (biofuels, bio-chemicals, and CO ₂ recycling) and bio-materials |
| | Frontier Materials Development Laboratory | ● | | ■ Development of advanced functional materials |
| | Advanced Battery Materials Research Laboratory | ● | | ■ Development of advanced battery materials related to all-solid-state lithium ion battery and lithium recovery technology |
| | Thin Film Device Laboratory | ● | | ■ Development of high-performance inorganic thin-film semiconductors and devices |
| | Analytical Technology Center | ● | | ■ Providing advanced analysis and solutions to a wide range of fields throughout the Group |
| | Idemitsu Kosan Collaborative Research Cluster for Advanced Materials | ● | | ■ Creating next-generation materials, enhancement and expansion of technologies |
| Production engineering | Technology & Engineering Center | ● | | ■ Technology development in the area of engineering design, construction, operation, quality control & assurance, and asset integrity & reliability ■ Technology-driven contribution to existing and new businesses |
| Lubricants | Lubricants Research Laboratory | ● | | ■ Research and development of lubricants and tribology (lubrication technology) |
| | Idemitsu Lubricants America Corporation R&D Center | | ● | ■ Local-based research and development of lubricants |
| | Idemitsu Lube (China) Co., Ltd. Research & Development Center | | ● | ■ Global development of lubricants products and technologies with the Lubricants Research Laboratory (Japan) as the mother research center |
| | Idemitsu Lube Asia Pacific Pte. Ltd. R&D Center | | ● | ■ Rapid product development and provision of technical services to meet local needs overseas |
| | NIPPON GREASE Co., Ltd. Technical Research Laboratory | ● | | ■ Research and development of grease, rust prevention oil, cutting oil, etc. |
| Advanced materials & performance chemicals | Performance Materials Laboratories | ● | | ■ Development of advanced materials through high-value-added petrochemical raw materials ■ Research and development of special polycarbonate resins and functional coatings |
| | Idemitsu Unitech Co., Ltd. R&D Center for Plastic Products | ● | | ■ Research and development of molded plastic products |
| | LION IDEMITSU COMPOSITES CO., Ltd. Composite Materials Research Laboratory | ● | | ■ Design, development, and analysis of customer grades of composite materials that meet customer needs |
| Electronic materials | Electronic Materials Development Center | ● | | ■ Research and development of OLED materials |
| | Idemitsu OLED Materials Europe AG | | ● | |
| | Inorganic Electronic Materials Development Group | ● | | ■ Research and development of oxide semiconductor materials |
| Bitumen | Technology Section | ● | | ■ Basic and applied research on asphalt and its applications ■ Development of high performance asphalt |
| Agri-bio | Agri-Bio Technology Section | ● | | ■ Development of active ingredients for pesticides and feed additives derived from microorganisms and natural products |
| | SDS Biotech K.K. Tsukuba Research & Technology Center | ● | | ■ Development of safe and useful products for the protection of livestock and plants and prevention of diseases |
| Lithium-ion battery materials | Battery Material Development Center | ● | | ■ Development of sulfide-based solid electrolytes for practical application in all-solid-state lithium ion batteries |
| Photovoltaic power generation | Advanced Product Development Section | ● | | ■ Research and development aimed at enhancing the performance and reducing the cost of existing CIS solar cell products as well as developing next-generation products |
| | Solar Frontier K.K. Kunitomi Plant | ● | | ■ Research and development aimed at commercializing the recycling of solar panels, including silicon-based panels |
| Coal and the environment | Coal & Environment Research Laboratory | ● | | ■ The only private research institute specializing in coal ■ Provision of technology services that anticipate needs and development of clean coal technologies to meet the needs of a low-carbon society |

■ Functional materials segment ■ Power and renewable energy segment ■ Resources segment