

Functional Materials Segment



Review of Operations

Idemitsu Group is developing lubricants, advanced materials & performance chemicals, electronic materials, functional asphalts, and agri-bio products using core technologies cultivated in petroleum refining and petrochemistry.

Lubricants

Business Environment Outlook

Lubricants are used in a wide range of fields, from automobiles and ships to industrial machinery. Since the required performance varies depending on the application, we develop and provide products that meet customer needs. Typical applications include automobile engines and transmissions, construction equipment actuators, wind power decelerators, and cutting oil used in metal processing.

As automobile sales in Japan have leveled off, the market for engine oil for automobiles is shifting to emerging countries, such as Asia, as car manufacturers and parts manufacturers move overseas. We also expect new demand for lubricants used in electric vehicles and other products to increase in order to realize a carbon-free society, which is becoming a global trend. As for industrial lubricants such as hydraulic oil and gear oil for industrial machinery, demand is also expected to increase worldwide for functional, environmentally friendly products that meet the needs for energy and resource conservation due to heightened interest in environmental issues.

Medium-term Management Plan Business Policy

In the lubricants business, based on our basic policy of "Continuing to create new values as a technology-based and community-based global lubricants manufacturer," we will promote further overseas expansion and product development in new fields.

In the field of automotive lubricants, we make full use of advanced tribology (lubrication technology) to provide OEM products that meet customer needs and support their business development. We also offer a wide range of products in the aftermarket, making the most of our extensive network in Japan and overseas to meet the diverse needs of our customers. In the field of industrial lubricants, we will apply technologies developed mainly in

Risks and Opportunities

Risk

- Slowing demand for engine oil and other internal combustion engine oil due to the spread of EVs
- Worsening profitability due to intensifying competition

Opportunity

- Increased demand in emerging countries
- Changes in demand characteristics due to increased energy and resource conservation needs
- New demand arising from technological innovations related to EVs
- Increased demand for aircraft parts processing and food processing

Japan to overseas R&D, accelerate the development and sales of products that meet local needs, and expand into China and South-east Asia. In particular, in the field of metalworking oil, we will develop products that incorporate cost and performance in a well-balanced manner at a development speed that meets local needs. In a new area, we will focus on the development of lubricants suitable for electric units of EVs and greases to meet the needs for high heat resistance and low noise caused by motor drive. In addition, we will actively promote the development of products that offer new values, such as naturally-derived and safe grease for food machinery.

TOPICS 1

Support for motor athletes challenging the world from Asia

Since 2013, Idemitsu has been a main sponsor of the racing teams that compete in the FIM Grand Prix World Championship and supporting riders challenging the world from Asia. The FIM Grand Prix World Championship takes place around the world and determines the champion. Races are divided into 3 classes according to engine displacement. In the top MotoGP, "LCR Honda IDEMITSU," Takaaki Nakagami belongs to, the Moto2 class with medium engine displacement, "IDEMITSU Honda Team Asia," and the Moto3 class with small engine displacement, "Honda Team Asia," we sponsor and support each team.

In addition, the ASIA TALENT CUP, in which we have been a main sponsor since 2017, was established in 2014 to discover young riders who can compete and play an active role at the world's top level. Riders from Japan and other parts of Asia and Oceania between the ages of 13 and 21 are participating. All six tournaments are held in one season, and riders are trained through their experience in races at the main circuit sites in Asia.



TEAM IDEMITSU

TOPICS 2

Product development through collaboration between Japan and overseas laboratories

Our strength lies in its ability to anticipate customer needs through its research laboratories specializing in lubricants. We conduct R&D not only in Japan but also in the United States, China, and Singapore. As a mother laboratory, Japan develops a wide range of lubricants for transportation machinery such as automobiles and ships, industrial machinery, and metal working processes, and dispatches researchers and provides guidance in order to train researchers at overseas laboratories.

Overseas R&D institutes have the same functions as those in Japan, and are focusing on developing products for the automobile industry in the United States where there is high demand for automobile lubricants, metal processing oil in China where rapid development is required, and locally specified products in Southeast Asia in Singapore. By doing so, we have established a system that enables rapid and high-level development, and we are responding to customer needs for optimal lubricants for machines that are advancing every day.

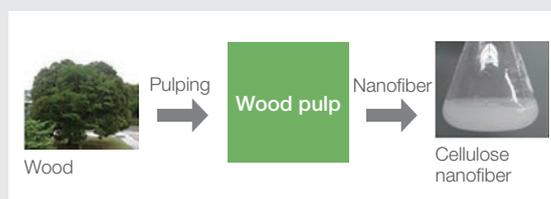
TOPICS 3

Development of naturally-derived and safe grease for food machinery

In the grease field, we are developing products made from cellulose nanofibers obtained from trees. We have developed a greasing technology for cellulose nanofiber and is working to apply it to food processing machinery.

■ Features

- Naturally-derived and safe
- Carbon neutral, biodegradable and low environmental impact
- Light weight and excellent tensile strength



Advanced Materials & Performance Chemicals

Business Environment Outlook

Technological innovation has accelerated in areas such as EVs, where advanced materials are used, and high-speed communications. As living standards continue to improve due to rising incomes in emerging countries, demand for automobiles, home appliances, daily necessities, etc. is expected to increase, particularly in Asia. In addition, the supply-demand environment is expected to deteriorate, as suppliers in emerging countries, mainly China, are starting to construct or expand production facilities for functional derivative products.

Medium-term Management Plan Business Policy

In the performance chemicals business, which handles engineering plastics, adhesive materials, derivative products, solvents, etc., we have positioned vehicles, information and communications equipment, daily necessities, and intermediates for durable consumer goods as growth markets. By offering solutions based on our own technologies, we aim to expand our business and become a core business supporting the functional materials segment. We will accelerate business growth by creating product synergies with other functional materials in the group, such as lubricants, and by aggressively acquiring resources through collaboration and M&A.

Risks and Opportunities

Risk

- Prolonged economic slowdown due to trade friction between the United States and China
- Deterioration of general purpose polycarbonate and hydrogenated petroleum resin market due to increased supply from Chinese suppliers
- Soaring cost of compound materials for SPS*
- Intensifying competition in technology development

* SPS : syndiotactic polystyrene

Opportunity

- Increased demand for functional materials for EVs, 5G high-speed communications and AI/IoT devices
- Increased demand for consumer goods and other daily necessities mainly in Asia
- Increased demand for basic chemicals and petrochemical derivative products as Asia grows

TOPICS

SPS (syndiotactic polystyrene)

SPS is a pure domestic engineering plastic that we succeeded in synthesizing for the first time in the world. Thanks to our proprietary technologies, it is highly heat-resistant (melting point: 270°C), hot water-resistant, insulating, and radio wave transmissivity. It is used in automotive parts, including electric vehicles, and antenna parts for high-speed communications equipment such as 5G. With the aim of supplying to Southeast Asia, where demand is expected to grow in the future, we plan to construct a No. 2 SPS production facility at the Pasir Gudang Complex in Malaysia and start commercial operation in August 2022.



Example of use of SPS resin (Product Name: XAREC™) automotive parts

Electronic Materials

Business Environment Outlook

Display manufacturers in South Korea and China are aggressively investing in OLED display manufacturing facilities, and the switch from conventional LCDs to OLED displays is expected to continue in many products, including smartphones and large-screen televisions. Demand for OLED materials is also expected to increase as the market for foldable phones, which take advantage of the flexibility inherent in OLED, begins to appear.

Medium-term Management Plan Business Policy

In addition to developing businesses centered on OLED materials, special polycarbonate resins for surface coating of Organic Photoconductor (OPC) drums, which are the heart of laser printers and copiers, and polyaniline, which is a conductive polymer used in capacitor electrodes and battery electrodes, we will promote the development of new businesses and applications. As for OLED materials, while deepening our relationships with display manufacturers and development partners, we will work to develop high-performance next-generation materials that contribute to energy saving and long lifetime of displays, including blue light-emitting materials in which our excels.

Risks and Opportunities

Risk

- Sluggish demand for displays due to the prolonged economic slowdown caused by trade friction between the United States and China
- Sluggish diffusion of OLED TVs
- Intensifying competition in technological development with competing material manufacturers
- Rise of new display technology such as MicroLED

Opportunity

- Accelerating the switch from LCDs in the smartphone and TV markets by reducing the cost of OLED displays
- Progress in switching from LCDs to new applications (PCs, tablets, automotive applications, etc.)
- Increase in replacement demand for smartphones due to the shift to 5G
- Expanding demand by creating new markets such as foldable phones and rollable televisions

High Performance Asphalt

Business Environment Outlook

In line with the government's policy to strengthen its national resilience for infrastructure, economic and social system, the domestic road-related budget remains at a high level, and demand for functional asphalt is expected to remain firm. As environmental awareness increases and the population structure changes due to the declining birthrate and aging population, there is growing interest in asphalt paving technology that contributes to CO₂ reduction, recycling asphalt technology, and extended pavement life technology. In Asia and the Middle East, demand for functional asphalt for both paving and waterproofing is expected to increase as economic grows.

Medium-term Management Plan Business Policy

As a "comprehensive asphalt manufacturer" that supplies asphalt for a wide range of applications, for roads, waterproofing materials for housing and industrial materials, we will fulfill our social mission of supporting infrastructure in Japan. Specifically, we are contributing to the reduction of CO₂ emissions from road construction and the reduction of road life-cycle costs through the development of various asphalt products, including technology for improving the workability by greatly reducing the allowable paving temperature, technology for recycling high-quality pavement, and technology for longer life of pavement and improving durability.

We will also expand the technologies developed in Japan to build infrastructure in Asia and the Middle East.

Risks and Opportunities

Risk

- Declining domestic population and depopulation in rural areas
- Deterioration of domestic market and profitability due to excess supply capacity
- Labor shortages in construction and transport industries
- Impact of IMO regulations on Asphalt Supply - Demand and Prices

Opportunity

- Growing needs to reduce environmental impact and CO₂ emissions
- Growing momentum toward permanent recycling of asphalt pavement
- Increasing needs for longer life of pavement
- Expanding demand for asphalt products in Asia and the Middle East



Example of use of light color asphalt (Meibrigh A) for landscape paving

Agri-bio Products

Business Environment Outlook

As global population increases and food demand increases, there are concerns that agricultural and livestock product production sites will experience a decrease in arable land area, an increase in feed grain consumption due to an increase in meat demand, and an increase in serious damage to agricultural products due to drought and other abnormal weather conditions. As a result, demand for agricultural and livestock materials that support efficient food production is increasing. At the same time, the need for naturally-derived materials such as biological pesticides continues to increase due to the tightening of regulations on the use of certain chemical pesticides and antibiotics mainly in Europe.

Medium-term Management Plan Business Policy

Based on the above environmental assumptions, we will contribute to improving the efficiency of global production of agricultural and livestock products by developing and popularizing naturally-derived biological pesticides and livestock materials. In particular, we plan to expand sales of biological pesticides, which are expected to expand worldwide, such as Tough Block (paddy rice seed fungicide), Boto-killer (fungicide) and Impression Clear (fungicide), which are expected to expand worldwide. We will also continue to develop new active ingredient for biological pesticides in cooperation with our major affiliate, SDS Biotech K.K. In the livestock business, we will strengthen sales of Ruminup (rumen function improving agent for cattle) and Molucca (probiotics), which have been well received by our customers, and promote activities for global expansion.

Lithium-ion Battery Material

Business Environment Outlook

Lithium-ion batteries provide higher capacity than primary batteries and have expanded their market for smartphones, mobile PCs, digital cameras and other products as rechargeable secondary batteries. The market for lithium-ion rechargeable batteries is expected to expand further as a result of spreading of EVs(electric vehicle), HEVs(hybrid vehicle) and PHEVs(plug-in hybrid vehicle) that incorporate lithium-ion batteries with improved driving range and safety due to heightened awareness of the realization of a low-carbon society, as well as expansion of their application to other consumer products such as energy storage and 5G devices.

Risks and Opportunities

Risk

- Japanese pesticide market stagnant due to decline in agricultural population and area
- Increased cost of pesticide development due to reduced probability of discovery of new chemical pesticides
- Expansion of scale gap with Japanese manufacturers through integration and reorganization of multi-national companies

Opportunity

- Expansion of global pesticide market due to population increase and food demand increase
- Shift to materials derived from microorganisms and plants by tightening of environmental regulations
- Growing need for functional natural materials to improve the productivity of agricultural and livestock products
- Expanding the potential for new businesses that contribute to the ESG by Combining our company's proprietary and advanced technologies



Medium-term Management Plan Business Policy

Liquid lithium-ion batteries, which are widespread today, use highly volatile and flammable electrolytes. We are conducting research and development on solid electrolytes which are the key materials for all-solid lithium-ion rechargeable batteries that are fire-resistant and safe, and are produced from lithium sulfide prepared by a unique production technology that utilizes hydrogen sulfide obtained from petroleum refining. Our initiatives for commercialization of solid electrolytes business is also in progress.