



NOF Group | Business Outlines

Message from the President



Since its founding in 1937, we at NOF Group have been expanding our business as a chemical manufacturer in multifaceted ways. We stay true to our management philosophy of “Contributing to Society by Generating New Value in Wide-ranging Fields from the Biosphere to Outer Space.”

Today, with the advancement of globalization of economy, societies around the world face various problems including the environment, food supplies, and natural resources. In this world, we believe we must play a strong role in order to support the sustainable development of societies, and to help them prosper.

As a corporate group that develops and provides

functional materials that contribute to prosperity, NOF CORPORATION will grow by investing our corporate resources in the three business fields of life sciences, electronics/IT, and environment/energy.

Furthermore, beginning with complying with regulations as a member of society, we will also fulfil our corporate social responsibilities in protecting the environment and guaranteeing safety in hopes that we will continue to be seen as a trusted company by our stakeholders.

We would like to extend our thanks to all of you for your continued understanding and support for NOF Group's business operations.

President & Chief Executive Officer Takeo Miyaji

From the Biosphere to Outer Space

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Aware of the fact that a company is a public asset of society and in view of its corporate social responsibility (CSR), we have set forth our Corporate Philosophy which guides us in conducting business activities, Code of Conduct which stipulates the actions and attitudes required for realization of the corporate philosophy, Basic CSR Policy which sets forth the action targets of the organization and Code of Ethical Conduct which prescribes the ethical aspect of the conduct of our executive officers and all our employees in implementing the corporate philosophy, code of conduct and basic CSR code.

Corporate Philosophy

The NOF Group is dedicated to contributing to mankind and society through the creation of new value "from the Biosphere to Outer Space".

- 1 Satisfy customer needs by providing the highest quality products and services on a global basis.
- 2 Leverage the Group's collective strengths to develop cutting-edge technologies and superior products that open up new possibilities.
- 3 Work in harmony with the environment and ensure the safety of products and business activities.
- 4 Maintain suitable levels of earnings and reward stakeholders with fair return.
- 5 Encourage employees to take on new challenges, working to create a rewarding place to work and fulfilling lifestyles.

Code of Conduct

Above all, listen to our customers
Transform customer values into tomorrow's success.
Develop exciting technologies
Focus your energy, work fast.
Protect the Earth's future Place priority on the environment and living things.
Generate strong earnings Create profits for everybody and a better tomorrow.
Take on ambitious challenges
Think innovatively for personal and business development.

Basic CSR Policy

We will fulfill our corporate social responsibility and conduct sustainable business activities.

1. We will, each and all, act in accordance with the highest standards of corporate ethics.
2. We will respect human rights, and enable a diversity of personnel to demonstrate their abilities.
3. We will promote responsible care activities, based on the five kinds of safety.
4. We will consider the interests of all of our stakeholders.
5. We will contribute to society in cooperation with local communities.

Code of Ethical Conduct

In order that we can maintain NOF CORPORATION's position as a good corporate citizen, earn and keep the trust of the community and continue to develop as a company, each and every one of us—employees and executives alike—shall abide by the code faithfully.

1 Compliance

We shall act in an ethical manner becoming of members of a company and society, and we shall obey the law and other regulations, and respect others' human rights.

2 The community

We shall give paramount priority in all processes of our business activities to human safety and health, as well as protection of the natural environment, and we shall work proactively to maintain a harmonious existence in all our local communities worldwide.

3 Respect for individuals

We shall not engage in any act that goes beyond the company's justifiable interests or that damages the company's credit or honor, and we shall respect the personality and individuality of all people.

4 Trading partners, business partners, civil servants

We shall always treat our trading partners and business partners fairly and equally and in good faith, and we shall not provide any civil servant with any benefits or favors.

5 Shareholders, investors

NOF CORPORATION is an open company, and we shall disclose the details of our management and business status and other corporate information in a timely fashion as required by relevant laws.

6 Company assets and information

We shall not use the company's assets for any purpose other than the company's official business objectives. We shall record and report accurately our business performance, protect intellectual property rights and hold confidential information and other companies' business secrets in strict confidence.

7 Fair trade

We shall comply with anti-monopoly laws and international trade laws, and we shall observe the Financial Instruments and Exchange Law and not engage in insider trading.

8 Antisocial behavior

We shall eliminate the influence of antisocial groups, and shall not provide undue benefits to specific shareholders.

Addressing Needs for Environmental Conservation

We believe that, for a chemical company to engage in sustained business activities, its activities and products should not only be useful to society but also in harmony with social environment and natural environment so that they can be recognized, appreciated and accepted by society.

Guided by this belief, in all our business activities, we faithfully observe relevant laws and regulations, at the same time behave with Responsible Care (RC), with a view to ensuring the safety and health of our stakeholders as well as conserving the environment and protecting the ecosystem and natural resources.

In our RC activities, which include dialogues with society in addition to the promotion of safety in five core components including environmental safety, product safety, plant safety, transportation safety, and labor safety, each works sets priority items, which are practiced in specific activities.

We will continue our contributions to the well-being of society by taking utmost care in environmental conservation and developing products and technologies embodying considerations for the environment, safety and health.

NOF Group's environmentally friendly products

- Greatly biodegradable asphalt-release agents and lubricants (Oleo & Speciality Chemicals)
- Oil for Refrigerators Using CFC Substitute Refrigerant not Depleting Ozone Layer (Oleo & Speciality Chemicals)
- Additive for Used Paper Recycling (Oleo & Speciality Chemicals)
- Admixtures for fly-ash concrete (Oleo & Speciality Chemicals)
- Recyclable cross-linked rubber substitutes (Functional Chemicals & Polymers)
- Chloride-Free Antifreeze (HOKKAIDO NOF CORPORATION)
- Chromium-Free Anticorrosive agent (Anti-Corrosion)



*Responsible Care

Responsible Care was started in 1985 by the Canadian chemical industry as a self-regulating movement. It involves responsibility for the preservation of the environment and the maintenance of safety and health in the entire cycle of R&D, manufacture, use and disposal of chemical products.



Corporate Overview

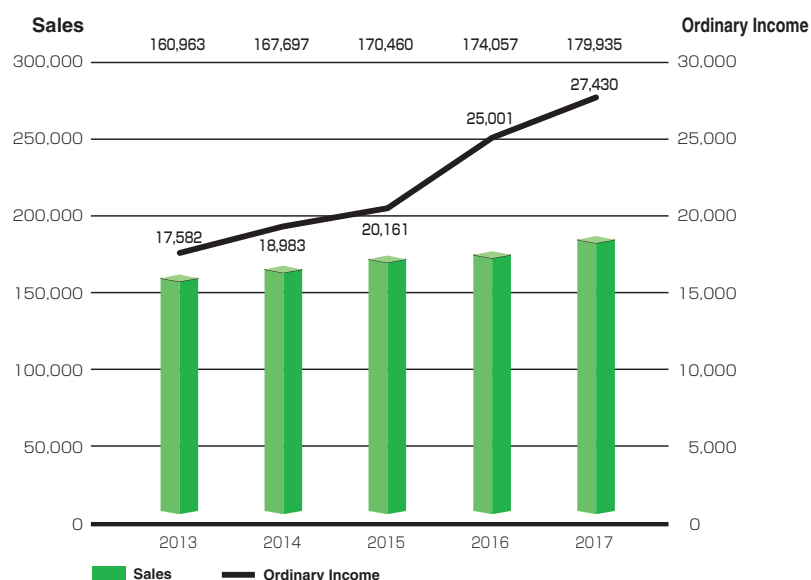
Establishment: June 1, 1937 (Incorporated on July 1, 1949)
Capital: 17,742 million yen (as of March 31, 2018)
Employees: 1,668 (as of March 31, 2018)
Head Office: Yebisu Garden Place Tower, 20-3, Ebisu 4-chome, Shibuya-ku, Tokyo 150-6019

Board of Directors

Executive Chairman	Akiharu Kobayashi	Outside Director	Yasuyuki Arima
President and Chief Executive Officer	Takeo Miyaji	Outside Director	Masayuki Kodera
Director and Executive Operating Officer	Kengo Inoue	Corporate Auditor	Satoru Otsubo
Director and Executive Operating Officer	Hideaki Sakahashi	Corporate Auditor	Kazushige Kato
Director and Executive Operating Officer	Kazuhito Maeda	Outside Corporate Auditor	Shinichiro Tanaka
Director and Operating Officer	Makoto Ihori	Outside Corporate Auditor	Ryouichi Tahara

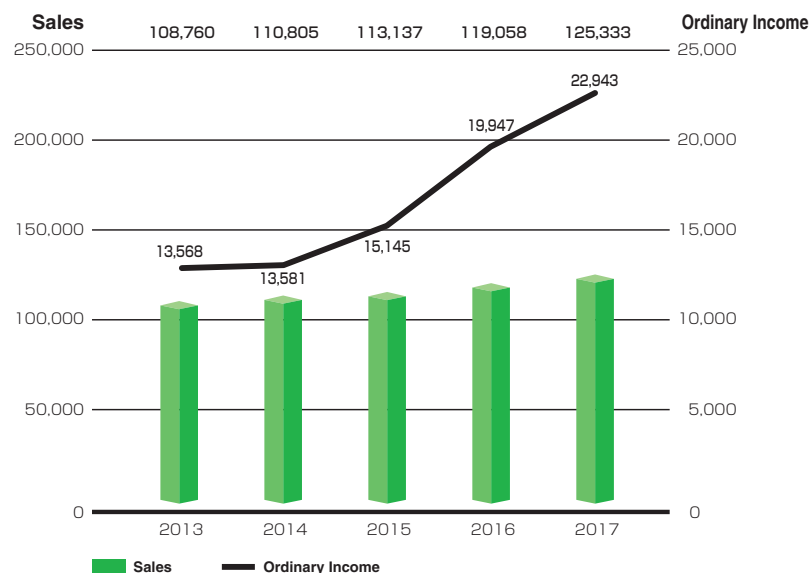
Business Performance (Consolidated)

● Sales and Ordinary Income (million yen)

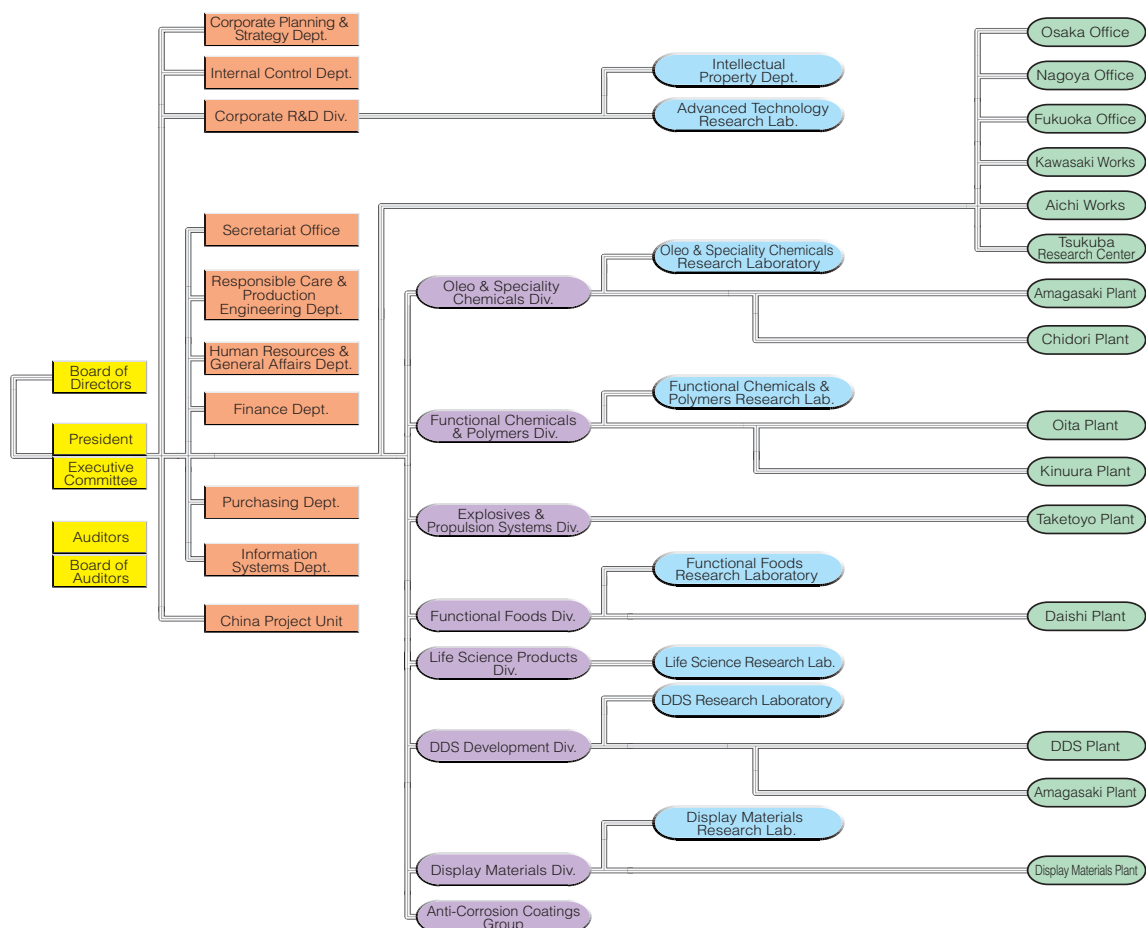


Business Performance (Non-consolidated)

● Sales and Ordinary Income (million yen)



Organization



Business Locations

Head Offices / Regional Offices / Branch Offices / Sales Offices

Head Office	Yebisu Garden Place Tower, 20-3, Ebisu 4-chome, Shibuya-ku, Tokyo 150-6019	TEL.+81-3-5424-6600	FAX.+81-3-5424-6800
Osaka Office	Shin-Fujita Bldg., 4-27, Dojima 2-chome, Kita-ku, Osaka 530-0003	TEL.+81-6-6454-6550	FAX.+81-6-6454-6570
Nagoya Office	Nagoya Mitsui Main Bldg., 24-30, Meiekininami 1-chome, Nakamura-ku, Nagoya, Aichi 450-0003	TEL.+81-52-551-6261	FAX.+81-52-551-2310
Fukuoka Office	Tenjin Saiwai Bldg., 2-20, Tenjin 4-chome, Chuo-ku, Fukuoka, Fukuoka 810-0001	TEL.+81-92-741-5131	FAX.+81-92-781-7070
Sapporo Office	Daito Bldg., 9, Minami-2-jo Higashi 2-chome, Chuo-ku, Sapporo, Hokkaido 060-0052	TEL.+81-11-281-9871	FAX.+81-11-281-9880

Works and Plants

Amagasaki Plant	56, Ohama-cho 1-chome, Amagasaki, Hyogo 660-0095	TEL.+81-6-6416-1321	FAX.+81-6-6416-8900
Kawasaki Works	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865	TEL.+81-44-288-2153	FAX.+81-44-288-7954
Chidori Plant	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865	TEL.+81-44-288-2153	FAX.+81-44-288-7954
Daishi Plant	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865	TEL.+81-44-281-2500	FAX.+81-44-281-2512
DDS Plant	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865	TEL.+81-44-288-3146	FAX.+81-44-288-3149
Oita Plant	2, Oaza-Nakanosu, Oita, Oita 870-0111	TEL.+81-97-527-5201	FAX.+81-97-524-0029
Aichi Works	61-1, Aza-Kitakomatsudani, Taketoyo-cho, Chita-gun, Aichi 470-2379	TEL.+81-569-72-1221	FAX.+81-569-74-0008
Taketoyo Plant	61-1, Aza-Kitakomatsudani, Taketoyo-cho, Chita-gun, Aichi 470-2379	TEL.+81-569-72-1223	FAX.+81-569-72-0914
Kamioka Test Center	1039-3, Wasabo, Kamioka-cho, Hida, Gifu 506-1105	TEL.+81-578-82-6050	FAX.+81-578-82-6022
Tanegashima Plant	3138-4, Hirayama, Minami-Tane-cho, Kumage-gun, Kagoshima 891-3702	TEL.+81-997-26-2961	FAX.+81-997-26-2963
Kinuura Plant	82, Aza-Nishimon, Taketoyo-cho, Chita-gun, Aichi 470-2345	TEL.+81-569-72-2563	FAX.+81-569-74-0009
Display Materials Plant	17-1, Aza-Shimada, Taketoyo-cho, Chita-gun, Aichi	TEL.+81-569-72-1832	FAX.+81-569-72-1499

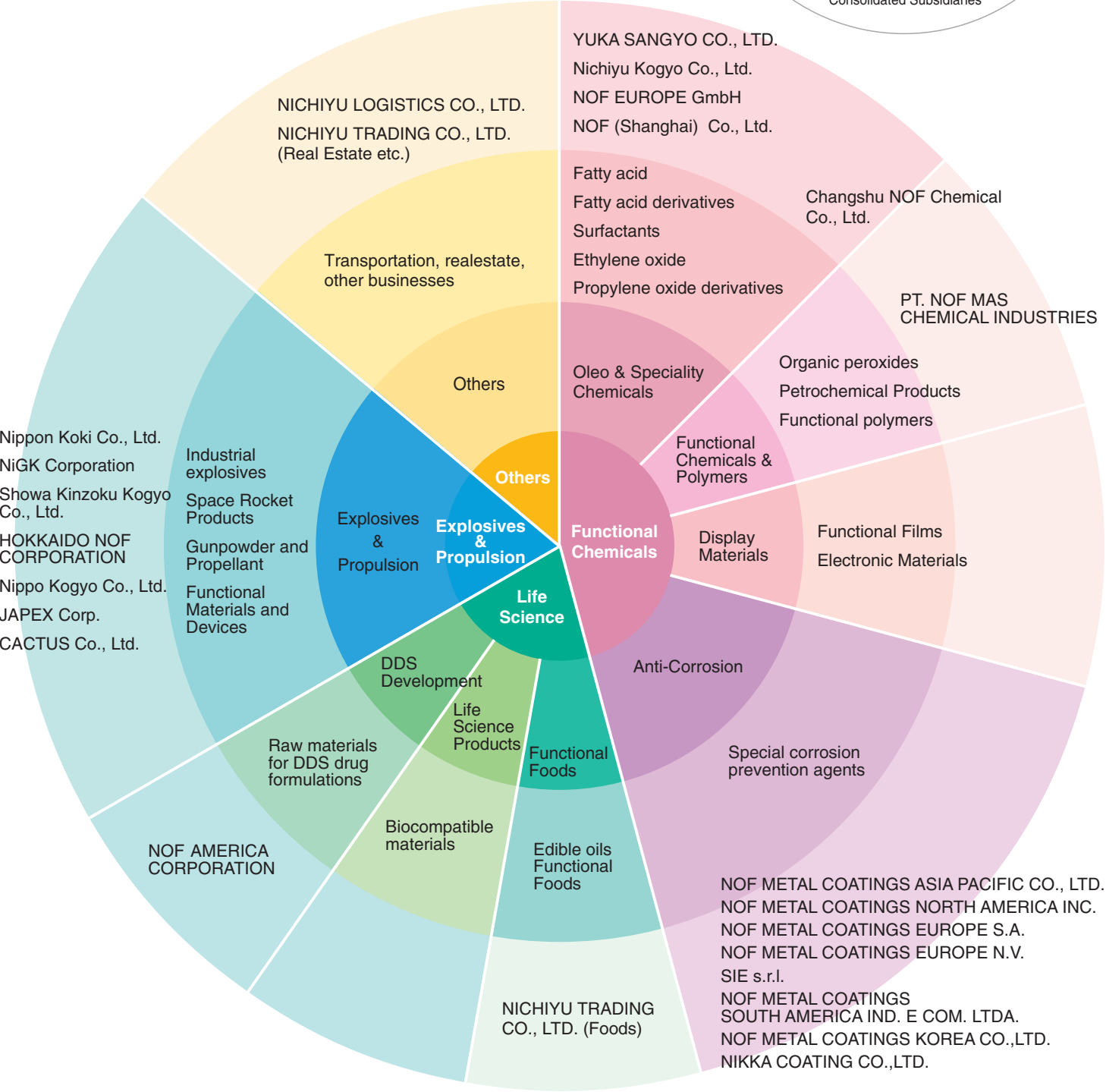
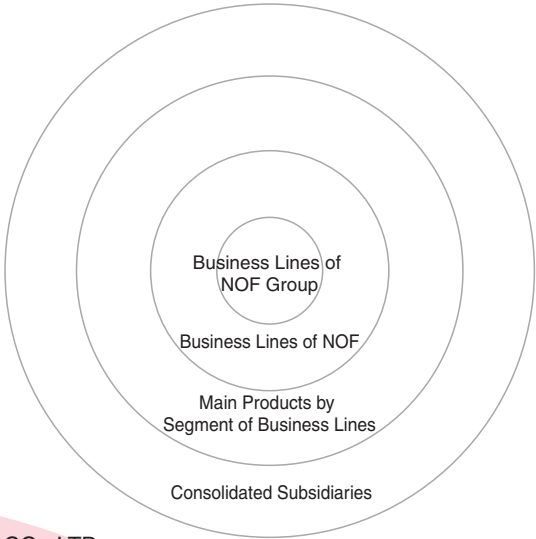
Research Laboratories

Tsukuba Research Center	10, Tokodai 5-chome, Tsukuba, Ibaraki 300-2635, Japan	TEL.+81-298-47-8891	FAX.+81-298-47-8862
Advanced Technology Research Lab.	10, Tokodai 5-chome, Tsukuba, Ibaraki 300-2635, Japan	TEL.+81-298-47-8891	FAX.+81-298-47-8862
Oleo & Speciality Chemicals Research Lab.	56, Ohamacho 1-chome, Amagasaki, Hyogo 660-0095, Japan	TEL.+81-6-6419-7484	FAX.+81-6-6419-4040
	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865	TEL.+81-44-288-7953	FAX.+81-44-288-7958
Functional Foods Research Lab.	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865	TEL.+81-44-281-2502	FAX.+81-44-281-2518
Life Science Research Lab.	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865	TEL.+81-44-288-2347	FAX.+81-44-288-2348
DDS Research Lab.	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865	TEL.+81-44-288-7952	FAX.+81-44-288-7958
R&D Department [Explosives & propulsion]	61-1, Aza-Kitakomatsudani, Taketoyo-cho, Chita-gun, Aichi 470-2379	TEL.+81-569-72-0917	FAX.+81-569-73-7376
Functional Chemicals & Polymers Research Lab.	82, Aza-Nishimon, Taketoyo-cho, Chita-gun, Aichi 470-2345	TEL.+81-569-72-1403	FAX.+81-569-74-0009
Display Materials Research Lab.	17-1 Aza-Shimada, Taketoyo-cho, Chita-gun, Aichi 470-2373	TEL.+81-569-72-1620	FAX.+81-569-72-1269

Business Lines and Consolidated Subsidiaries of NOF Group

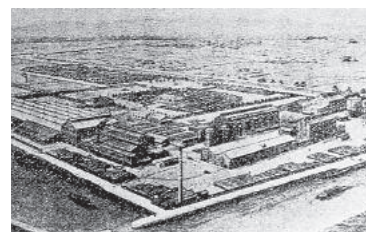
The chart corresponds to the Group's businesses, main products by segments, consolidated subsidiaries.

More detailed information can be found in securities reports, business reports and other documents disclosed by the Group.



Chronology

1910	09/1910	Japan Lever Brothers (now the Amagasaki Plant) established
	08/1917	Suzuki Shoten oil refinery (the former Oji Plant) established
	11/1919	Teikoku Explosives Industries Co., Ltd. (now the Aichi Works, Taketoyo Plant) established
1930	06/1936	Nippo Kogyo Co., Ltd. (Former Nippon Shikki Co., Ltd.) established
	06/1937	Nippon Oil & Fats Co., Ltd. established (Head Office: Nissan-kan)
	01/1938	Hokkaido Oil and Fats Industries and 14 other companies merge
1940	02/1943	Showa Kinzoku Industries, Ltd. established
	04/1945	Acquired the chemical division of Nippon Mining Co., Ltd., name changed to Nissan Chemical Industries, Ltd.
	06/1947	NICHYU TRADING CO., LTD. (Former Nissei Shoji Co., Ltd.) established
	07/1949	Company reestablished as Nippon Oil & Fats Co., Ltd. following the enactment of the Economic Deconcentration Law (Head Office: Shirokiya in Nihonbashi, Tokyo)
1950	10/1951	Head office moved to Marunouchi Tokyo Building
	10/1954	Production of rocket propellants started
	02/1957	Production of organic peroxides started
1960	07/1961	Nichiyu Kogyo Co., Ltd established
	11/1961	Chidori Plant begins operations
	02/1966	YUKA SANGYO CO., LTD. established
	05/1967	Head office moved to Yurakucho Building in Tokyo
1970	06/1970	Merged with Teikoku Pyrotechnics Co., Ltd.
	06/1973	Nippon Dacro Shamrock Co., Ltd. (now NOF METAL COATINGS ASIA PACIFIC CO., LTD.) established
1980	12/1980	Nichiyu Giken Kogyo Co., Ltd. (now NiGK Corporation) established
	02/1983	Tsukuba Corporate Research Laboratory opened
	09/1984	Metal Coatings International Inc. (now NOF METAL COATINGS NORTH AMERICA INC.) established in U.S.A. DACRAL S.A. (now NOF METAL COATINGS EUROPE S.A.) of France made a subsidiary by the company at the same time.
	12/1988	NOF AMERICA CORPORATION established in U.S.A.
1990	01/1991	German subsidiary Nippon Oil & Fats GmbH established
	10/1992	Kamioka Test Center established
	03/1994	HOKKAIDO NOF CORPORATION established
	07/1994	NOF EUROPE N.V. established in Belgium, and Nippon Oil & Fats GmbH dissolved
	11/1994	Head office moved to Yebisu Garden Place Tower, Tokyo
	11/1995	PT. NOF MAS CHEMICAL INDUSTRIES set up in Indonesia
	02/1996	JAPEX Corp. established
	12/1997	Tanegashima Plant completed
	10/1999	Nippon Koki Co., Ltd. made a subsidiary after acquisition of shares
	12/1999	Life Science Products Division set up
2000	10/2001	DDS Development Department set up
	04/2004	All Taseto Co., Ltd. shares sold to Shinko Taseto Co., Ltd.
	06/2004	Daishi Plant completed
	10/2004	Changshu NOF Chemical Co., Ltd. established in China
	10/2004	NICHYU LOGISTICS CO., LTD. established
	03/2005	All shares in BASF NOF Coatings Co., Ltd. sold to BASF Coatings AG
	07/2005	DDS Plant completed
	06/2006	Anti-Corrosion Coatings Group set up
	10/2007	Japanese trading name changed to Nichiyu Kabushikigaisha
	04/2009	YUKA SANGYO CO., LTD. bought out Nichiyu Solution Inc.
2010	09/2010	Nichiyu Giken Kogyo Co., Ltd. (now NiGK Corporation) became a wholly owned subsidiary by exchange of shares.
	07/2012	Tsukuba Corporate Research Lab. was reorganized into Tsukuba Research Center.
	04/2013	Display Materials Division set up
	11/2014	NOF EUROPE (BELGIUM) N.V. is moved Germany, NOF EUROPE GmbH established



▲Amagasaki Plant in 1910 when it opened



▲A ceremony for establishment of NOF CORPORATION (Nippon Oil & Fats Co., Ltd. at the time) on July 20, 1937

NOF Group (List of Main Companies)

Business	Company Name * Consolidates subsidiaries	Business Line	Address	TEL	FAX
Oleo& Specialty Chemicals	*YUKA SANGYO CO., LTD.	Sales and production of raw materials for cosmetics, pharmaceuticals, oleochemical and chemical products, paper making chemicals, calcium fatty acid for animal feed, etc.	Ebisu Neonato, 1-18 Ebisu 4-chome, Shibuya-ku, Tokyo 150-0013, Japan	+81-3-5791-4101	+81-3-5791-5200
	*Nichiyu Kogyo Co., Ltd.	Production of oleochemical and chemical products	22-1, Dou-cho 4-chome, Takatsuki, Osaka 569-0011, Japan	+81-72-669-5141	+81-72-669-5144
	JEUNE BEAUTY Corporation	Production of cosmetics and toiletry products	Yebisu Garden Place Tower, 20-3 Ebisu 4-chome, Shibuya-ku, Tokyo 150-6019, Japan	+81-3-3442-6331	—
	Nichiyu Techno Co., Ltd.	Chemical analysis	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865, Japan	+81-44-280-0701	+81-44-280-0704
Oleo&Specialty Chemicals/ Functional Chemicals & Polymers	*Changshu NOF Chemical Co., Ltd.	Production of fatty acid derivatives and organic peroxides	Wan fu road, Riverside Industrial Park, Chang shu Economic Development Zone, Jiang Su Province 215537, China	+86-512-52275252	+86-512-52275218
Functional Chemicals & Polymers	*PT. NOF MAS CHEMICAL INDUSTRIES	Production and sales of organic peroxides	Kawasan Industri Bekasi Fajar, Blok D-1 Mekar Wangi, MM2100 Industrial Town, Phase III Cibitung-Bekasi 17520, INDONESIA	+62-21-898-0636	+62-21-898-0638
Explosives & Propulsion Systems	*Nippon Koki Co., Ltd.	Production of defense equipment and industrial explosives; production and sales of pyrotechnics and crime prevention products	Nagatanien Bldg., 36-1 Nishi-Shinbashi 2-chome, Minato-ku, Tokyo 105-0003, Japan	+81-3-3436-3711	+81-3-3433-5505
	*NiGK Corporation	Production and sales of thermal indicator materials for temperature control, sterilized medical materials, construction materials, electrical materials, rocket components, processed chemical materials and marine equipment	2 Matoba Shinmachi 21, Kawagoe, Saitama 350-1107, Japan	+81-49-231-2103	+81-49-232-1334
	*Showa Kinzoku Kogyo Co., Ltd.	Production and sales of gun detonators, blanks, various pyrotechnics, and gas generators for seatbelts	Iwase 2120, Sakuragawa, Ibaraki 309-1211, Japan	+81-296-76-1811	+81-296-76-1815
	*HOKKAIDO NOF CORPORATION	Production of industrial explosives; production and sales of road anti-icing agents and dispensing equipment and Explosive disposal	549 Koshunai, Bibai, Hokkaido 079-0167, Japan	+81-126-67-2211	+81-126-62-1114
	*Nippo Kogyo Co., Ltd.	Production; Shot Shells for Hunting and Shooting, Magic Joint, Automatic HolePunch Import and Sales; Shotguns, Rifles and Ammunitions	Chabatake 1838, Susono, Shizuoka 410-1121, Japan	+81-55-992-0476	+81-55-993-2805
	*JAPEX Corp.	Sales of industrial explosives	Shinbashi Chuo Bldg., 11-5 Nishi-Shinbashi 1-chome, Minato-ku, Tokyo 105-0003, Japan	+81-3-3506-9061	+81-3-3580-8244
	*CACTUS Co., Ltd.	Sales of electrical equipment, welding materials, thermal indicator materials for temperature control, sterilized medical materials and other products	Sengoku Coathouse Bldg., 37-4 Sengoku 4-chome, Bunkyo-ku, Tokyo 112-0011, Japan	+81-3-5940-3671	+81-3-5940-3679
Anti-Corrosion Coatings	*NOF METAL COATINGS ASIA PACIFIC CO., LTD.	Production and sales of anti-corrosion agents	3-3, Chidori-cho, Kawasaki-ku, Kawasaki, Kanagawa 210-0865, Japan	+81-44-280-3017	+81-44-280-3119
	*NOF METAL COATINGS NORTH AMERICA INC.	Production and sales of anti-corrosion agents	275 Industrial Parkway Chardon, Ohio 44024 -1083, U.S.A.	+1-440-285-2231	+1-440-285-5009
	*NOF METAL COATINGS EUROPE S.A.	Production and sales of anti-corrosion agents	ZAET Creil Saint Maximin, 120 rue Galilee, CS 50093, 60106 CREIL CEDEX, France	+33-3-44-646362	+33-3-44-646340
	*NOF METAL COATINGS EUROPE N.V.	Production of metal anti-corrosion agents	Bouwelven 1, Industriezone Klein-Gent, BE-2280 Grobbendonk, Belgium	+32-14-259831	+32-14-224563
	*SIE s.r.l.	Sales of anti-corrosion agents	Via. Avogadro, 11 10121 TORINO(TO), ITALY	+39-011-5627022	+39-011-537121
	* NOF METAL COATINGS SOUTH AMERICA IND. E COM.LTDA.	Production and sales of metal anti-corrosion agents	Rua Minas Gerais No85 Vila Oriental CEP 09941-760 Diadema Sao Paulo, Brazil	+55-11-4071-5651	+55-11-4071-4118
	*NOF METAL COATINGS KOREA CO., LTD.	Production and sales of metal anti-corrosion agents	9F Munhwailbo B/D, 22, Saemunan-ro, Jung-gu, Seoul 04516, Korea	+82-2-571-4051	+82-2-571-4053
	NOF METAL COATINGS SHANGHAI CO., LTD.	Sales of anti-corrosion agents	3rd Floor West, Gems Bldg, No.487 Tianlin Rd, Shanghai 200233, China	+86-21-6120-4020	+86-21-6120-4021
	NIPPON C&Z CO., LTD.	Sales and production of metal surface treatment systems	Nagoya Dia Bldg. No.1, 16-22 Meieki 3-chome, Nakamura-ku, Nagoya, Aichi 450-0002, Japan	+81-52-571-5512	+81-52-551-5513
	*NIKKA COATING CO., LTD.	Metal corrosion prevention coating	Higashi-Saitama Technopolis, 3-6 Asahi, Yoshikawa-shi Saitama 342-0008, Japan	+81-48-991-9854	+81-48-991-9858
Others	*NICHYU LOGISTICS CO., Ltd.	Truck transportation, freight handling business	3-2, Chidori-cho, Kawasaki-ku, Kawasaki Kanagawa 210-0865, Japan	+81-44-280-0560	+81-44-280-0563
	*NICHYU TRADING CO., LTD.	Sales of edible oils, health-related products, coatings, chemical products for civil engineering-construction material, Insurance agency and real estate business	Ebisu Neonato, 1-18 Ebisu 4-chome, Shibuya-ku, Tokyo 150-0013, Japan	+81-3-5789-8211	+81-3-3445-2777
Overseas Sales	*NOF EUROPE GmbH	Import, export and sales of NOF Group's products and other Chemicals	Mainzer Landstrasse 46, 60325, Frankfurt am Main, Germany	+49-69-7706-100-0	+49-69-7706-100-10
	*NOF AMERICA CORPORATION	Import, export and sales of NOF Group's products and other Chemicals	One North Broadway, Suite 912, White Plains, N.Y. 10601, U.S.A.	+1-914-681-9790	+1-914-681-9791
	*NOF (Shanghai) Co., Ltd.	Import, export and sales of NOF Group's products and other Chemicals	Room 2402, 24F, Huanning Plaza North Building, No.300 Xuanhua Road, Changning District, Shanghai 200050, China	+86-21-62101100	+86-21-32080270

Oleochemical business has led the industry as a pioneer of the oleochemistry field in Japan since it was established in 1910.

Oleochemical business is the core business of the NOF group, which has a long history as an oleochemistry pioneer, and remains the leader in this field in Japan.

At present, in addition to oleochemical products such as fatty acids, their derivatives, and surfactants, a variety of functional products based on alkylene oxide derivatives, (meth)acrylic acid esters, etc. in petrochemistry have been developed for growing fields with remarkable technological innovation such as resources, environment and energy field, electronics and information technology field, healthcare fields. In the future as in the present, oleochemical business will be not only pursuing further potentialities in oils and fats, always new materials, but also developing high-function and high-value-added products in many fields of oleochemistry and petrochemistry based on original our technical skills accumulated in a long period of time to expand the business based in these growth fields with high technology.



Amagasaki Plant: Produces various fatty acids and glycerin from natural oils and fats. A great number of functional compounds are manufactured from fatty acids and glycerin.



Chidori Plant: Manufactures a diversity of alkylene oxide derivatives from ethylene oxide and propylene oxide.



Changshu NOF Chemical Co., Ltd. (China): Produces fatty acid derivatives (since 2004).

Main Products

Fatty Acids

Hydrogenated triglycerides, General fatty acids, Distilled high-purity fatty acids, Stearic acid, Oleic acid, Glycerin, and Fatty alcohols

Fatty Acid Derivatives and Surfactants

Metallic soaps, Anionic, Cationic, Nonionic, and Amphoteric surfactants, Lubricants for fibers, Lubricants for metals, Additives for synthetic resin, Emulsifiers for polymerization, Materials for pharmaceuticals, Detergent for laundry, Emulsifiers for food, Feed additives, Chemicals for paper making, Chemicals for fermentation industry, Various materials for detergents, Additives for use in civil engineering, building, and ceramics

Petrochemicals

Polyethylene glycol, Polypropylene glycol, Polyalkylene glycol, Defoaming agents, Reactive epoxy resin diluents, (Meth)acrylate derivatives, Fire retardants, and Various polyalkylene glycol derivatives



Mild surfactants: Used in various products such as shampoo and body soap.

Healthcare

Cosmetics and pharmaceutical materials

NOF develops and commercializes a wide range of cosmetics and pharmaceutical materials by leveraging precision synthesis and our original refinery technologies.

MACROGOL and POLYSORBATE, NOF's high-quality ethylene oxide derivatives, are widely applied in pharmaceutical products for their low impurity content, almost negligible odor, as well as almost colorless colors. WILBRIDE® and MACBIOBRIDE®, which are alkylene oxide derivatives developed with NOF's original designs and production technologies, are highly appreciated for their excellent moisture retention and user comfort. PARLEAM® enjoys global popularity as a high-quality polybutene oil with a wide range of properties, from volatile low-molecule oils through base oil as an alternative to squalene, to highly viscous oils that effectively bring out luster. Both LIPIDURE® and CERACUTE® are original high-value-added materials provided by NOF that have been well received as upscale cosmetics. LIPIDURE® is a highly functional polymer with excellent moisture retention and skin protection performance, owing to its phospholipid-like structure. CERACUTE® is an anti-aging material for regenerating young, supple skin inspired by ceramide as an intercellular lipid. NOF proposes the optimal use of its original materials in combinations with other materials to obtain synergistic effects to unleash their full potential, thereby achieving high added value in clients' final products.

Mild surfactants

For daily use, customers prefer shampoos and body washes (body soaps, etc.) that minimize irritation to the skin and eyes. NOF is among the first companies to adopt a basic product concept that responds to said need by offering a variety of mild surfactants according to the intended properties of hair and body washes. Many final products employ NOF's mild surfactants, including familiar amino acid-based products like DIAPON®, NISSANANON™ LA, and SOFTILT®. The market has highly acclaimed these surfactants, and expectations are high for future product development.

■ Resources, environment, and energy

◆ Biodegradable lubricants

Biodegradable lubricants reduce environmental loads because they naturally decompose microbially into water and carbon dioxide. The MILLUBE® E Series of biodegradable lubricants uses fatty acid polyol esters, NOF's core products, as the base oils. In addition to high biodegradability, these products exhibit excellent lubricating performance, low toxicity, and flame retardance owing to the high flash point. The series is safe for both nature and humans, making the products particularly suitable for application in oceans, lakes, ports, coasts, forests, farms, and leisure facilities. Examples include lubrication of water gate operators and auxiliary equipment in rivers, hydraulic backhoe for underwater excavation, and vibro-hammers for driving piles underwater. The flame-retardant lubricant is perfect for lubricating equipment for steelmaking, rolling, and other such equipment that operates under extremely high temperatures.

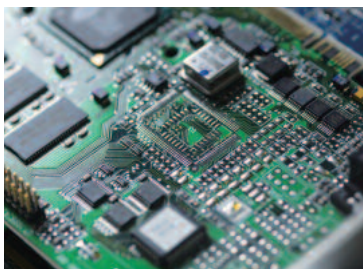


MILLUBE® E series:
Used in hydraulic backhoe for underwater excavation

■ Electronics and information technology

◆ Highly functional acrylic polymers

Highly photoreactive acrylic polymers are in ever increasing demand due to the current pursuit of smaller electronic components with faster processing speeds. These polymers are effectively employed to make photo-sensitive resists, conductive pastes, adhesives, ultraviolet curable coating, and so forth. NOF has also developed monomers that easily bind with different types of materials, which are applied as new binders for metal and ceramic nanoparticles.



Electronics-related materials: Fatty acid technology is now expected for use in electric, electronic, and information-processing areas.

◆ Esters and metal salts of fatty acids

Chemical materials with unique properties are sought to keep pace amidst the growing sophistication of information, communication, and other electronic devices. NOF is launching radically new materials to meet needs in relevant fields of industry by applying our technologies for refining fatty acids, synthesizing esters, and making metal soaps. Examples include lubricants for electronics materials that apply, for example, melting behaviors and electrical properties of highly pure fatty acid esters; imaging materials that apply particle behaviors and electrostatic properties of the first-ever metal soaps with a grain size of around 1 μm ; and mold release agents for electronic products.

■ Civil engineering and chemical industries

◆ Cement additives

MALIALIM® was developed by combining technologies for producing maleic anhydride as well as derivatives of ethylene oxides and propylene oxides. The product acts on cement particles at the liquid-solid interface to achieve advanced control of their aggregation. Great expectations are placed on MALIALIM® as an important additive to meet growing demand for stronger, more durable concrete structures achieved with less water.

◆ Fatty acid chlorides and amines

NOF produces fatty acid chlorides by replacing hydroxyl groups at the end of fatty acid molecules with chlorine. These products serve as acylating agents for transferring acyl groups to other compounds in order to produce amino-acid-based surfactants, functional polymers, and so forth. NOF provides NISSANAMINE®, a product series of aliphatic amines whose terminal carboxyl groups are induced to amino groups. The product lineup includes primary aliphatic amines, tertiary aliphatic dimethyl amines, tertiary aliphatic polyoxyethylene alkylamine, and aliphatic alkyl propylene diamines. In addition to being intermediates for chemical products, these aliphatic amines are useful as antistatic agents, lubricant additives, water treatment agents, and so on.

NOF Group Companies and Product Development

● Using many kinds of fatty acids, NOF Group Companies produce and market feed additives for pigs, and both dairy and beef cattle. The additives are widely used for stock raising purposes, gaining high reputation of users. The products are applicable together with the other additives including minerals.

● Reduction of deposits generated in the process of paper making will be essential to save resources and to recycle waste paper further more. The NOF Group has been solving this problem with its superior technology and developing deposit control agents (paper making additives) which have already been introduced to major paper making mills in Japan.



Deposit control agent, SPANOL®:
The product demonstrates its superior performance to reduce impurities that generate in the paper-making process.

● Metal working fluids (METALEX® series), etc Metal cleaning agents, corrosion inhibitors and metal working fluids, made from various activating agents are available. In recent years, a lot of efforts have been made focusing on environmental concerns, to develop eco-friendly cleansers for the use of inks, paints, adhesives and sugar making processes, focusing on environmental concerns.

Functional Chemicals & Polymers Division has been expanding organic peroxides business since the start of production in 1957, and we are now developing various businesses based on organic peroxides, functional polymers and petrochemicals.

NOF CORPORATION has become a world leading manufacturer of organic peroxides by continuous R&D for new products and applications in this field. In the business of functional polymers, we develop high performance polymers such as unique graft and block copolymers applied to the improvement of plastics and other synthetic resins.

In the business of petrochemicals, we produce polybutene, isoparaffin-based odorless solvents and other products, which make a substantial contribution to the various industrial field.

We will continue to focus on the cutting edge materials for the next-generation technology and develop the frontier of chemistry by innovation.



Kinuura Plant: Organic peroxides and high performance polymers.



Oita Plant: Polybutene, isoparaffin-based odorless solvents, etc.

Main Products

Organic Peroxides

Curing agents for unsaturated polyesters,
Polymerization initiators for polyvinyl chloride, low-density polyethylene, polystyrene, acrylic resins and other polymers,
Cross-linking agents for polyolefins and synthetic rubbers

Functional Polymers

Surface modifiers, sliding and anti-excoriation improvers for plastics,
Compatibilizers for polymer alloys,
Anti-fog agents for automotive headlamps,
Thermoplastic elastomers,
Low shrinkage agents for unsaturated polyesters

Petrochemical Products

Polybutene,
Isoparaffin-based odorless solvents



Encapsulant for solar cells: Organic peroxides are used for a wide range of plastics and synthetic resins, etc.

Organic Peroxides

Organic peroxides are used as initiators, curing agents and cross-linking agents in the applications for plastics, synthetic rubbers, packaging materials, solar cells, bathtubs and golf balls, etc.

NOF CORPORATION has succeeded in industrialization of organic peroxides by our own technology in 1957 and been actively developing a lot of products and new applications meet the customers' needs.

Our quality and technological development capabilities are highly praised as the Japan's leading and one of the most comprehensive manufacturer in organic peroxide business in the world.

We were awarded the Technology Prize of The Society of Synthetic Organic Chemistry, Japan in 1965 and the Chemical Technology Prize from The Chemical Society of Japan in 1967 for our safe manufacturing technology of high quality organic peroxides.

We established PT. NOF MAS CHEMICAL INDUSTRIES(NMC) in Indonesia in 1995 and Changshu NOF Chemical Co., Ltd. in China in 2004 as overseas production facilities.



PT. NOF MAS CHEMICAL INDUSTRIES (Indonesia) : Organic peroxides since 1995.



Changshu NOF Chemical Co., Ltd. (China): Organic peroxides since 2004.

■ High Performance Polymer Products MODIPER®/NOFALLOY® Series

The MODIPER®/NOFALLOY® series are high performance polymer products developed by using radical block or graft polymerization technology that won the Chemical Technology Prize of The Chemical Society of Japan. Products of MODIPER® series are highly appreciated as modifiers, compatibilizers for polymer alloys and anti-fog agents. In addition, NOFALLOY® series, thermoplastic elastomers are excellent in oil and heat resistance. We continue to develop high performance materials for customers' needs.



MODIPER® and Organic Peroxide are used for the bathroom equipments



Anti-fog agents used for automotive headlamps

■ Petrochemicals

Established Oita Plant in 1969 to produce petrochemicals using C4 (butane, butene, etc.) fractions and are manufacturing isoparaffin-based odorless solvents. These products are contributing to the growth of various industries such as cosmetics, lubricants, adhesives, insulating oil, and others.

The explosives and propulsion business has created highly functional product lines with excellent R&D activity and production expertise and application technology with the highest priority of safety, and provided them since the explosives business commenced at NOF CORPORATION in 1919.

At present, the NOF Group, as a rare general explosives maker in the world, establishes a firm business foundation and expands the businesses for explosives for industrial use, explosives for defense and space development use, and articles for the public welfare.

The business for explosives for industrial use contributes to national land development including boring tunnels with emulsion explosives, electric detonators, and remote controlled blasting devices.

The business for propellants for defense and space development use contributes to national defense and space development by supplying highly efficient products in full use of up-to-date technology such as gunpowder, gun bullets, solid propellants for rockets, and blasting devices.

In addition, the business for articles for the public welfare contributes widely to the society by supplying products to various areas related to daily lives such as automotive safety devices, marine equipment, thermal indicator materials, sterilizing materials, pharmaceutical materials, and crime prevention devices.

In the future as well as in the present, the Group will challenge the future by making full use of the up-to-date pyrotechnics (blasting device technology).



Taketoyo Plant: Produces various explosives of high quality under the system taking all possible measures to ensure the safety.

Kamioka Test Center: Carries out evaluation tests of various explosives underground at the foot of Oku Hida Mountains, taking safety and environment into consideration.



Tanegashima Plant on Tanegashima Island (Japan Aerospace Exploration Agency): Contributes to space development in Japan by taking charge of producing solid propellants for space rockets.

Main Products

- **Explosives**
Emulsion explosives, and Ammonium nitrate fuel oil explosives (ANFO)
- **Gunpowder & Propellants**
Smokeless gunpowder for sporting and hunting uses, Smokeless gunpowder for defense use, Solid propellants for defense use, Warhead explosives, and Solid propellants for space use
- **Explosive Loading & Assembly**
Missiles, gun ammunitions, blank cartridge, and mine
- **Pyrotechnics**
Detonators, Various pyrotechnic devices for rockets, Safety blasting equipment, Burglar alarm systems, Static fragmentation agents, and Explosive disposal
- **Automotive Safety Devices**
Micro gas-generators for seatbelt pretensioners
- **Pharmaceutical Materials**
Nitroglycerine-based pharmaceutical materials for heart disease treatment and Materials for medical sterilization use



H-II B Rocket: NOF CORPORATION supplied the high-performance solid propellant used for solid-rocket boosters. (Photo courtesy of JAXA)

■ Solid Propellants for Space Rockets

In August 2001, aiming at Japan's entry into the commercial satellite market, the Japan Aerospace Exploration Agency (JAXA) (the former National Space Development Agency of Japan (NASDA)) successfully launched the H-IIA rocket. The H-IIA rocket consist of two parts, a liquid rocket engine that is fueled by liquid hydrogen and liquid oxygen, and a large solid rocket booster based on NOF's propellant technology, providing the same launch capacity as other large rockets for placing an over two-ton satellite into a geostationary orbit. In December 1997, NOF opened its Tanegashima Plant in the JAXA rocket-launching base to contribute to efficient launching preparation.

In September 2009, NOF also played a role in the successful launch of an H-IIB rocket that carried the H-II Transfer Vehicle (HTV) to resupply the space station. Following the retirement of the M-V rocket using solid propellant in all stages in 2006, our company was involved in the development of an Epsilon rocket, whose testing machine was successfully launched in 2013. Now we are involved in the development of H3 rockets as the next main engine following H-IIA and B.



SRB-A motor for H-IIA rocket: Solid rocket boosters use NOF's high-performance solid propellant. (Photo by courtesy of JAXA)

■ Hayabusa 2 Impactor (explosion section)

The Hayabusa 2, asteroid explorer, is the successor to Hayabusa, which successfully returned to the earth in 2010, and was launched in December 2014 by an H-IIA rocket. The Hayabusa 2 is equipped with an Impactor, a new item not found in its predecessor. The Impactor is separated from the Hayabusa 2 and launches high-speed metal liner with the force of explosives and forms artificial craters in small planets. This Impactor (explosion section) was developed by Nippon Koki Co., Ltd., a member of the NOF Group, jointly with the Japan Aerospace Exploration Agency (JAXA).



■ Industrial Explosives

Industrial explosives supplied by the NOF Group enjoy a high reputation in land, ocean development and various mining operations for their outstanding reliability. High-performance high-safety emulsion explosives developed in response to the increased emphasis on safety are used in a broad range of engineering activities including tunnel blasting. For blasting purposes, the company also developed a new system; an electromagnetic induction type remote control blasting (RCB™) system that makes possible underwater blasting, previously considered extremely difficult, and used it for the construction of the Seto Bridge. The application of these technologies has enabled us to achieve practical applicability of the electromagnetic induction blasting system (MBS®) and the centrally controlled blasting system. Furthermore, NOF has developed jointly with Kajima Corporation a remote explosive charging system Safecharger® for greater safety of facing work, and thereby contributed to enhancing the safety of explosive charging for mountain tunnel projects.



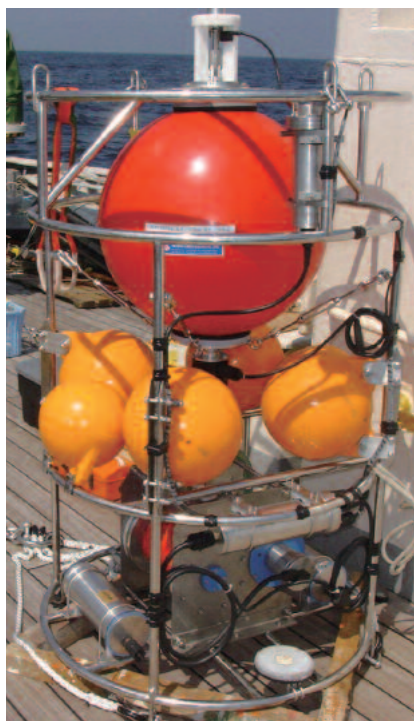
Industrial explosives for specific requirements:
HIGH JEX® emulsion explosive.

■ GANSIZER®

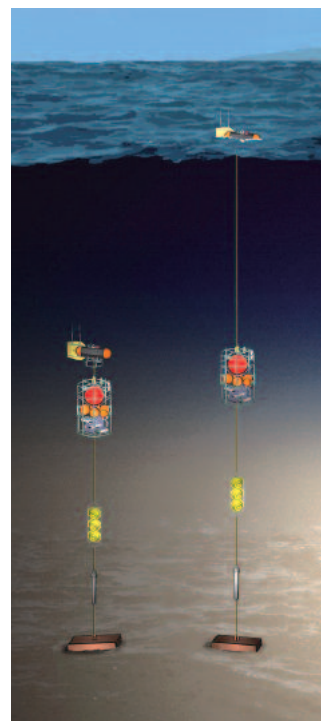
Nippon Koki Co., Ltd., a member of the NOF Group, developed for the first time in the industry a low-vibration breaking method using a steam pressure fracturing agent, GANSIZER®. GANSIZER® breaks rock beds, rocks and concrete structures among others in a low-vibration state with water steam pressure generated by thermal reaction of chemicals. By virtue of its friendliness to the surroundings, it is highly appreciated and extensively used in projects for underwater destruction of breakwaters destroyed by the East Japan Great Earthquake/Tsunami, tunnel digging, large-scale land development, deep foundation digging, quarrying and so forth.

■ Oceanographic Survey Devices

One of the project themes of worldwide importance in the 21st century is the development and exploitation of oceans. Japan has a major role to play in ocean development activities, projects of which account for a great proportion in the nation's development initiatives in general. NiGK Corporation of the NOF Group, committed to R&D on survey equipment necessary for ocean observation and investigation, has developed an “automatic underwater disconnection device” using a solid type gas generator based on its own pyrotechnics. The company has also developed various advanced exploitation devices combined with ultrasonic measurement and control techniques. The mooring system for oceanographic observation, a typical composite product among the systems used in this field, is in the limelight as a vertical profile for use in relatively shallow waters. NOF also provides a wide variety of equipment for oceanographic research, including a system for remote monitoring of distant oceanic environment and a boring machine system for exploration of natural resources under sea, all contributing to the dramatic progress of ocean science. Now that global environmental problems are attracting grave concern, government agencies, research bodies, academia and industry, both in Japan and elsewhere, are heavily counting upon and finding keen interest in the making of products and the supply of technical services both supported by secure safety and reliability.



Underwater automatic elevator unit



Mooring system for oceanographic observation



Nippon Koki Co., Ltd. : Manufactures and markets various gun ammunitions for defense use, and explosives, pyrotechnics and precision devices for industrial use.



NiKK Corporation : Manufactures and markets various products required by medical sterilization, ocean, and space exploitation.

■ Gunpowder

Since its establishment, NOF CORPORATION has constantly been producing high-performance products under the strict quality control system for defense and industrial purposes. Based on expertise with rich experiences, the company continues to develop new products. New developments include gunpowder used for antiaircraft machine guns, tank guns, practice-projectiles and new type multi-purpose howitzers.



Gunpowder

■ Propellant

Production of rocket propellant started in 1954. It is mainly used for defense-use rockets and missiles. The NOF Group has marketed various propellants such as double-base and composite propellants. Their performance is highly reputed by the users together with technology developed by the Group. The Group is now targeting new production technology as well as new propellant consisting of new compositions, with higher performance, and available at a low cost.



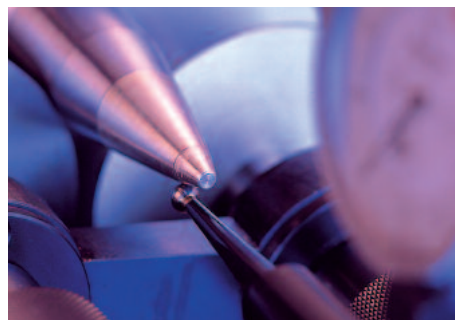
Extruded type solid propellants

■ Gun Ammunitions

The NOF Group companies, Nippon Koki Co., Showa Kinzoku Kogyo Co., Ltd. and Nippo Kogyo Co., Ltd. are now producing and marketing every type of small and medium caliber gun ammunitions for defense and civil use. For large caliber gun ammunitions, the Group conducts explosive and gun powder loading and assembly.



Various small caliber blank cartridges



Checking by a special gauge

■ Pharmaceutical Materials

NOF manufactures nitroglycerin-based drug substances which are said to be effective against angina. These substances are prescribed to an increasing number of heart disease patients in Japan stemming from the aging society and increasingly Westernized diet. Thus, our chemicals business is making a social contribution through its medicines.

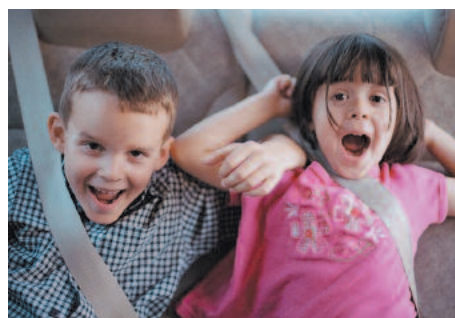
Angina pectoris treatment drugs for buccal, taping, and injection purposes:

The drug uses nitroglycerine-based pharmaceutical materials developed by the NOF Group.



■ Safety devices for automotive use

In the U.S., it became mandatory for the 1990 and later models of automobiles of all types to be equipped with air bags or passive seat belts, and in Japan, too, the use of such on-vehicle safety devices as standard items made rapid progress. Showa Kinzoku Kogyo Co., Ltd. and Nippon Koki Co., Ltd., both members of the NOF Group, respectively produce and sell gas generators for use on seat belt pretensioners and gas generating agents for use in air bag inflators. These products embody the integrated capabilities of the group to place momentary energy of explosives under control to make it useful for our everyday life.



Seatbelt Pretensioners

■ Security Equipment

Net Launcher[®] manufactured and marketed by Nippon Koki Co., Ltd., another member of the NOF Group, enables anyone to easily extend and fly a net if any suspicious person has invaded his or her home, and to catch the suspect in the net. As the caught invader cannot move freely, the would-be victim can earn time to escape or call the police.



Net Launcher[®]

**Net Launcher[®] is a registered trademark of Nippon Koki Co., Ltd. in Japan

The Functional Foods Division has always been a pioneer in the innovations in edible oils and fats re-refining and processing techniques since it was established in 1917. At present, it is expanding its business areas such as processing oils and fats for food and the health related business.

The processing of oils and fats for food contributes widely to the food industry by striving for the development of products in pursuit of deliciousness based on the technologies cultivated as a pioneer of processing oils and fats such as margarine, shortening, refined fat for confectionery use, depanning oil, filling and topping materials, powder oils and fats, and materials for cooking and frozen foods.

The health related business has developed one new product after another such as functional lipids, emulsifying and nano-emulsion products, oils and fats coating products, and external nutritional products while striving for steady researches to provide the society with health.

The Functional Foods Division will supply products which can contribute to the society by enriching people's "food culture" step by step, tasty and healthy.



Daishi Plant

The state-of-the-art plant conforming to HACCP specifications including the prevention of cross-contamination and complete zoning.

■ Edible Oil

Edible oils and fats play not only an essential role in keeping us in good health as one of the three major nutrients but also a principal role in making many kinds of food. NOF CORPORATION has extensively contributed to the advancement of the food industry by supplying edible oils and fats including margarine, shortening, fillings, emulsified oils and fats, and oils and fats powders for use in a diversity of processed foods.

Availing ourselves of our unique oils and fats processing technologies, the company can promptly and appropriately respond to further diversification in food-related needs. By making proposals for new market creation through the development of new kinds of bread or confectionary and ready-to-eat or frozen foods which capitalize on the functions of oils and fats, the company will remain committed to enriching people's "food culture" step by step in a visible and appreciable way.

Main Products

- **Shortening**
Use for confectioneries and bakeries
- **Margarine**
Use for confectioneries/bakeries, spread, non-dairy cream, cooking, and frozen foods
- **Oils and fats for non-dairy cream**
Whipped cream and coffee whitener
- **Fillings and toppings**
Use for confectioneries, bakeries, and cooking
- **Powder oils and fats**
Use for instant foods, snack food, frozen foods, and feed additives
- **Depanning oil**
Use for bakeries and confectioneries (of western and Japanese styles)
- **Nutritional foods for medical uses**
- **Foods for special dietary uses**
- **Functional lipids**
- **Micro-encapsulated products (fat coatings)**
- **Nano-emulsion products**
- **Antibacterial agent**
- **Ingredients for food products**



Functional Foods

■ Functional Fats

NOF develops functional fats that are necessary for a healthy life by mobilizing our company's technologies for extracting, refining, and stabilizing fats. With our own original refining, deodorizing, and processing technologies, our company took the lead in the commercialization of DHA, a functional component also contained in breastmilk. The company's research and development covers not only fats, but all kinds of fatty materials to release a wide array of functional fatty materials to the market. Today, our high-value added materials are highly evaluated in the health food market. Examples include PS (Phosphatidylserine) as functional phospholipids and policosanol (Komecosanol®) as a higher fatty alcohol.



Functional oil or fat:

Blended dietary supplements containing NOF's functional fat

■ Fat-coated Products

NOF's original technology for coating core materials with fats can provide useful functions such as enhanced taste, masking of taste, protection against humidity, and avoidance of unwanted contact, and it is being applied in foods, feed, and other areas. This technology can coat powder materials at ordinary temperature, which has made it possible to commercialize a wide array of coated products, such as vitamins and natural extracts in response to health needs.

Its application is expanding further with a combination of our newly developed coating technologies using water-soluble substances to provide resistance against acids and enhanced bioabsorbability.



Fat-coated products:

Blended dietary supplements containing NOF's fat-coated products

■ Nutritional foods for medical uses

NOF CORPORATION is engaged in the development of nutritional foods for medical uses, which embody advanced food processing know-how based on the nutritional physiology of lipids.

Nutritional foods for medical uses include enteral formulas utilized to place patients difficult to eat ordinary meals under appropriate dietary control and blended food containing medium chain triglyceride (MCT) having special physiological functions for kidney disease patients whose protein intake should be restricted.



Against the background of an increase of the senior age group, "appropriate nutrition control, tailored to each individual patient, is essential for efficient remedies against diseases" is widely recognized. Combined with the advances made in clinical nutrition like this, NOF's medically prescribed nutritional food business is contributing to a society of health and longevity.



Nutritional foods for medical uses:

SANET®-SA, bag Z, enteral diet

* "SANET" is a registered trademark of NUTRI Co., Ltd. in Japan

■ Solubilized Products

Building on fat emulsification technologies cultivated over many years, NOF is developing solubilized products by reliably dispersing lipophilic components that are otherwise insoluble to water. Solubilization is a technology for emulsifying lipophilic components and cutting emulsified particles to nanometer sizes so they become soluble in water. Unlike the previous techniques, this new technology makes it possible to blend lipophilic and water-insoluble components into beverages and jelly. In addition, it provides new features such as transparency, oxidation stability of solubilized materials, and enhanced bioavailability, which are then applied to develop liquids containing solubilized vitamins and functional lipids.



Solubilized Products:

NOF's solubilized products are used in many different beverages.

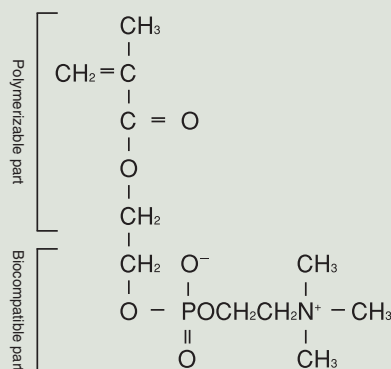
In the life science portfolio, NOF has been expanding its share of the biocompatible materials market in earnest, having consolidated its operational system after the company's success in the development of the production technology for LIPIDURE®, MPC polymers (2-methacryloyloxyethyl-phosphorylcholine) with phospholipid polar groups.

The application extends across eye care, skin care, oral care, and other care products, as well as medical devices, and diagnostic pharmaceuticals. Our products are highly appreciated in each of these fields.

Our wealth of technologies in molecular designing, refining, and evaluation has been fully mobilized for further development of new applications and products. Armed with our key technologies, we will strive to create innovative values and thereby enhance quality of life (QOL).

MPC (2-methacryloyloxyethylphosphorylcholine):

Biocompatible monomers (Biomaterials)



Oita MPC Plant: Located in Oita Petrochemical Complex. A pioneer of the world in establishing the manufacture plant for MPC monomers and polymers.

Key products

■ Biomaterials

- Contact lenses
- Skin care and oral care
- Hand sanitizers
- Coating materials of medical devices
- Additives for biochemical or in-vitro diagnostic agents

■ Diagnosis and research reagents

- Assay reagents
- Oxidative stress markers



Eye-drops Formulated with MPC Polymer (2-methacryloyloxyethylphosphorylcholine polymer)

■ Biomaterials

Gaining support from the Japan Science and Technology Agency, NOF led the world in completing a commercial plant with an integrated process for turning monomers into polymers of MPC (2-methacryloyloxyethyl-phosphorylcholine). This innovative biocompatible material is composed of a part resembling cell membranes and a part with a polymerizable group. The resulting high bioaffinity achieves excellent skin moisture retention and antithrombogenicity for preventing adsorption of proteins and the like.

NOF offers polymers made from MPC under the brand name of LIPIDURE®.

• Materials for contact lenses

Due to the high biocompatibility of contact lenses made with MPC, the US Food and Drug Administration (FDA) permits their use even by persons who tend to feel discomfort associated with the drying of contact lenses in their eyes.

The addition of polymer of MPC into a packaging solution for soft contact lenses can achieve excellent resistance against drying, dirt, and bacterial contamination.



- **Materials for skin care and oral care**

Skin care functions are gaining attention, as an increasing number of people suffer from skin trouble.

LIPIDURE® can protect skin from irritating materials with its excellent absorptive performance and moisture retention. The product is also attracting attention as an effective oral care material due to the discovery of its ability to repel bacteria causing cavities, to protect mucosal cells from toxins produced by bacteria causing periodontal diseases, and to mitigate bitter taste.

- **Hand sanitizers**

There is an increasing need for hand sanitizers in response to outbreaks of new strains of influenza. Conventional products inevitably caused rough skin. NOF's hand sanitizers developed by effectively applying the skin protection function of LIPIDURE® are proving to be popular among consumers.

- **Materials for coating medical devices**

Antithrombogenicity is one of the features expected from medical devices and artificial organs. LIPIDURE® is gaining attention as a coating material for artificial organs, catheters, and other medical devices that require antithrombogenicity as it keeps platelets and proteins away.

- **Additives for biochemical or in-vitro diagnostic agents**

LIPIDURE® is also a high-performance and totally synthetic additive for biochemical research. Unlike biological materials, the synthetic polymer carries no risk of infection. It is highly stable against heat, freezing, and thawing. There are no worries of cross reactions or differences between lots. The molecular weight, hydrophobic-hydrophilic balance, and electrochemical properties can be freely controlled with this synthetic chemical product. For these reasons, the product facilitates reagent management, enhances reagent performance, and eliminates biological hazards.



Hand sanitizers

■ **Diagnosis and research reagents**

- **Assay reagents**

NOF offers blocking reagents for immunoassay and peroxidase stabilizers. Their main components are totally synthetic polymers. No BSA or any other animal-derived materials are used for making them. Numerous advantages offered by these synthetic materials include excellent blocking effect and enzyme stabilizing effect.

- **Oxidative stress markers**

Antibodies for immunological research

Oxidative stress is believed to cause arteriosclerosis, cancers, diabetes, and other diseases associated with aging. NOF develops markers for measuring such oxidative stress with lipids, DNA, and sugars. At present, the company sells anti-acrolein (ACR) antibodies, anti-4-hydroxynonenal (HNE) antibodies, anti-malondialdehyde (MDA) antibodies, and anti-crotonaldehyde (CRA) antibodies as lipid peroxidation markers. As markers for oxidative DNA damage, the company sells anti-8-hydroxydeoxyguanosine (OHdG) antibodies, and for oxidation of sugars, anti-methylglyoxal (MG) antibodies. These markers are effectively used in the research of diseases associated with aging and adult lifestyle habits, as well as in the development of foods for suppressing harmful reactive oxygen species in our bodies (anti-oxidant foods for preventing aging).

The Drug Delivery System (DDS), which maximized the efficacy of pharmaceuticals, has been used for many commercial drugs and products for improving the quality of patient nursing.

Especially, it focuses on the technology that nano-size drug delivery carrier can be applied for enhancing their pharmaceutical capabilities and efficacy by adjusting their biological activity, side effects, ability to target on the nidus, chemical stability, metabolic activity and other factors, and thereby bringing the required quality of the drug to work on the exact position needing the drug in the patient's organs for the required duration.

In the DDS field utilized such nano-technologies, NOF provides creative pharmaceutical materials developed by our unique synthesizing, refining and quality control technologies and experiences, including polyethylene glycol (PEG) derivatives, phospholipids, Ultra-pure Polysorbate, and other novel pharmaceutical excipients.

We will continue to contribute to Drug Delivery Systems (DDS) renovation with our high purity products and novel technologies.



Clean Room: To supply our secure products, the manufacturing is carried out in GMP controlled clean room.



Amagasaki Plant: In 1987, GMP production facilities of phospholipids were completed, enabling NOF to supply high purity phospholipids for liposomal pharmaceuticals ahead of the world.



DDS Plant: In 2005, the GMP production facility began to supply PEG derivatives for DDS.



PEG derivatives

NOF's PEG derivatives are applied in DDS.

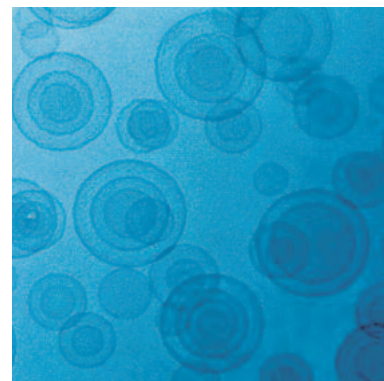
■ PEG derivatives

Due to their excellent biocompatibility, PEG derivatives are used as small molecule drugs, proteins, antibodies, peptides, nucleic acids as pharmaceutical material and medical materials. NOF provides the SUNBRIGHT® series of PEG derivatives for Drug Delivery System by utilizing our proprietary technologies of polymer and organic synthesis and purification technologies.

We also offer the PUREBRIGHT® series of linkers for ADCs (antibody-drug conjugates) toward the booming antibody drug market.

■ Phospholipids

NOF offers the COATSOME® series of highly-purified phospholipids under GMP production for liposomal products in pharmaceutical. In addition, NOF is developing PEG-lipids and nucleic acid and gene delivery lipids for nucleic acid and gene therapeutics.



Electron micrograph of liposome
(Photo by courtesy of FEI Japan Ltd.)

■ High-purity polysorbates

Polysorbates are used as excipients, such as emulsifiers, solubilizers, and stabilizers in pharmaceuticals. NOF offers polysorbates made with high-purity oleic acids by using advanced ethylene oxide addition technology and proprietary technology as multi-compendial product (JP, EP and USP).



Polysorbate 80 (HX2)™

In April 2013, NOF integrated its functional films business and electronic materials business to launch a new display materials business. The functional films business developed functional films one after another, including the anti-reflection(AR) film ReaLook®, AirLike®, which was the first such product in the world made by wet coating, the anti-fingermark(AFM) film ClearTouch®, the AFM-AR film PureFace®, and PenFit® featuring the pentouch feeling it gives to pen input devices, and thereby expanded the scale of its activities. In addition, our company has developed functional molding films for imparting functions to three-dimensional curved surfaces in anticipation of the increasing need for more sophisticated designs for displays, and they are highly appreciated by our clients. The electronic materials business meanwhile continued to develop innovative techniques, embodying as its key technical asset the company's original technologies that won chemical technology awards of The chemical society of Japan. Especially NOFCURE®, developed as an application of blocked carboxylic acid hardening techniques and finding many new users both in Japan and abroad, is now enjoying the growing sales in the display materials market. The new business division will fuse the technologies built up by its two forerunners in pursuit of synergy effects in accelerating the development of new areas of business and strengthening the potential for new product development. It will continue to offer products excelling in functional performance and winning customers' satisfaction even more.



Display Materials Plant: manufactures anti-reflection films, anti-fingermark films, and other functional films.



Display Materials Plant: manufactures blocked carboxylic acid related products.

Main Products

- Functional Film Products
- Blocked Carboxylic Acid Hardened Products



■ Functional Film Products

NOF will continue to develop unique functional films by fully utilizing its unparalleled three core technologies including the "materials developing technology", "product designing technology," and "thin layer coating technology."

Anti-reflection (AR) film ReaLook®, AirLike®

ReaLook® and AirLike® are AR films for electronic displays which can suppress the reflection of fluorescent light and obtain good visibility of the image by sticking (bonding) the film to the surface of display. In our product lineup, we have types which has additional function to AR films such as smear-proof and anti-glare (AG) function. Furthermore, by choosing the suitable film from our abundant lineup, it is applicable to not only electronic displays but also for exhibit (such as showcase of arts, museums) and building material uses. Above all, AirLike® is super low reflection film that has outstanding AR performance.

• Anti-fingermark (AFM) film ClearTouch® and anti-fingermark anti-reflection (AFM-AR) film PureFace®

Touchscreens used for finger typing like those in smartphones, tablets, and car-mounted displays suffer reduced visibility when tainted by fingermarks.

Fingermarks are less noticeable when NOF's AFM film ClearTouch® and AFM-AR film PureFace® are applied as fingermarks on these films spread out, reducing the scattering of light. They also make it much easier to wipe off fingermarks. Both the clear type and anti-glare type of PureFace® have anti-reflective properties.

• Z series of functional molding films

AFM films: ClearTouch® Z series

AFM-AR films: PureFace® Z series

The recent pursuit of enhanced design for smartphones, tablets, and car-mounted displays has led to the popular use of three-dimensional displays and touch panels. NOF developed ClearTouch® Z series and PureFace® Z series for mold injection in response to customer needs for imparting anti-fingermark and anti-reflective properties to three-dimensional curved surfaces. Z series can deform along the inner surface of molding cavity owing to the extensibility of substrate and functional layer, so that the surface of the molded can have functions such as anti-fingermark and anti-reflection.

■ Blocked carboxylic acid related products

• NOFCURE® : Over coating agent for liquid crystal displays

Over coating agent for liquid crystal color filters is based on NOF's original blocked carboxylic acid as a hardening agent. The liquid has excellent stability for preservation, and it achieves a highly functional color filter configuration with its transparency and flatness, while preventing contamination of liquid crystal with a highly dense cross-linkage.

Anti-Corrosion Coatings

The Anti-Corrosion Coatings Group has accumulated the most advanced surface treatment technologies with the core of highly original techniques for anti-corrosion agents to become a global de facto standard of the anti-corrosion for automotive parts.

At present, this Group has built a global network covered by NOF METAL COATINGS ASIA PACIFIC CO., LTD. which conduct businesses in Japan and Asia/Pacific Region, by NOF METAL COATINGS NORTH AMERICA INC. in U.S., and by NOF METAL COATINGS EUROPE S.A. (a French company) in Europe to supply anti-corrosion agents to automotive production bases worldwide.

In the future as well, this Group, giving the top priority to environmentally friendly surface treatment, will develop highly functional products and improve anti-corrosion technologies.



NOF METAL COATINGS ASIA PACIFIC CO., LTD.
(in Japan)



NOF METAL COATINGS ASIA PACIFIC CO., LTD. (Japan) GEOMET® Treatment Facility: Operation was started in June 2006.



NOF METAL COATINGS NORTH AMERICA INC.
Head Office (in U.S.)

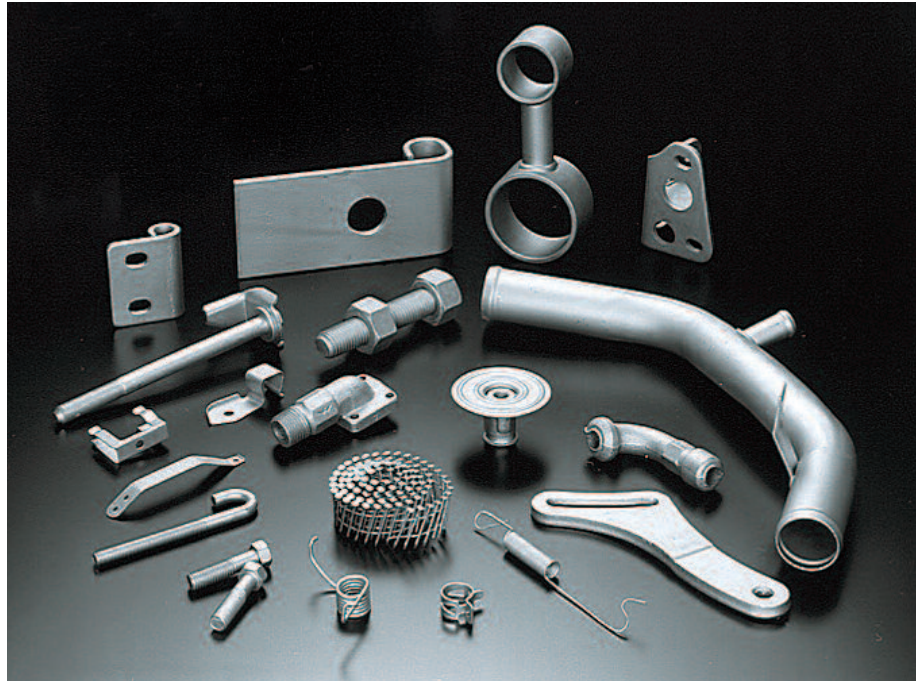


NOF METAL COATINGS EUROPE S.A.
Head Office (in France)

Main Products

- Rust prevention water-type chrome-free coating agent for automotive parts

Environmentally Friendly Surface Treatment



GEOMET® Treatment Parts:

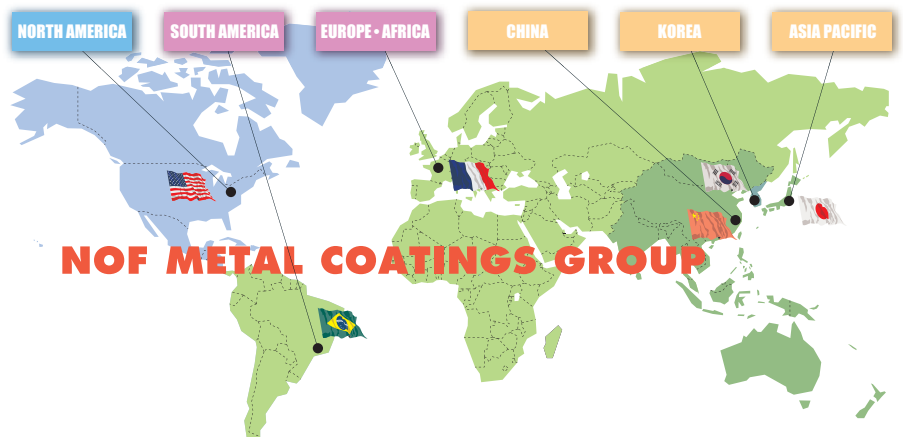
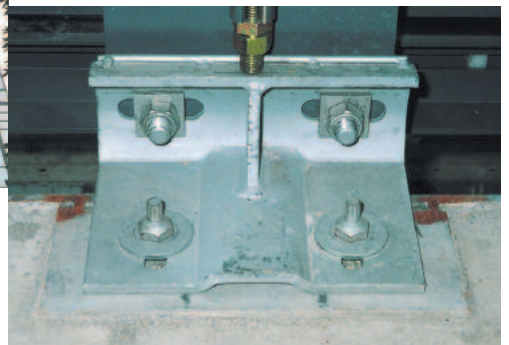
Car manufacturers worldwide now use GEOMET® Treatment, a completely chrome-free rust prevention coating.



Dacrotized® Treatment Parts:

This surface treatment system is now widely applied to segment bolts, bridge bolts and civil engineering work as well as automobiles.

Recently the system is also used for fasteners for prefabricated houses, home electric appliances, and marine equipment.



Sales Territories of This Group Companies

*"GEOMET®" and "Dacrotized®" are the registered trademarks of NOF METAL COATINGS NORTH AMERICA INC in Japan.

Research & Development

Innovative Materials, Advanced Technologies.
Create cutting-edge technologies by developing new innovative materials.

Today, the developments of IT and Information appliance are going to change our life style, and the technological innovations in the life science are trying to reach the essence of life.

In this "Time of remarkable technological innovation", there is a need for Chemical Materials that can adapt to "Change of technology".

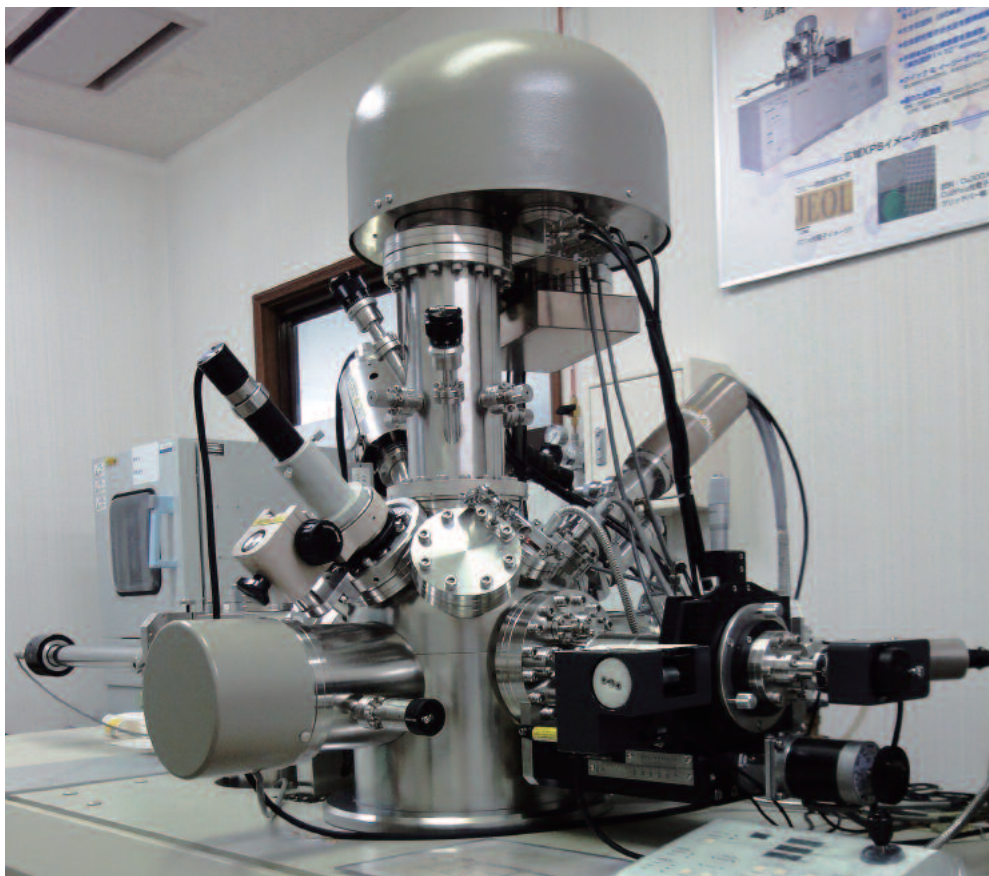
Our R&D organization is comprised of the following nine Laboratories and the Corporate R&D division. Five laboratories are for supporting the core business units (Oleo & Speciality Chemicals, Functional Chemicals & Polymers, Explosives & Propulsion systems, Functional Foods, Display Materials). And, three laboratories are for the priority business areas (Life science, DDS) to specialize, and the remaining one is for Corporate R&D division that does not belong to any business units.

In order to correspond to "Time of remarkable technological innovation", NOF is continuing challenging to develop new technologies and new products by taking the social needs of near future at the R&D laboratories of each business unit.

Corporate R&D division is responsible for planning the Corporate R&D strategies, and adjusting the cooperation between each business unit.

In addition, this division is responsible for developing "fundamental technologies" of innovative materials and advanced technologies which have wide applicability and impact on performance and productivity in the future.

Corporate R&D division is searching new materials and new technologies world-widely, and challenging to develop innovative materials and advanced technologies for the new era through cooperating within and outside.



Advanced Technology Research Lab.

Advanced Technology Research Laboratory

The Advanced Technology Research Laboratory is engaged in development of "fundamental technologies" of innovative materials and advanced technologies which have wide applicability and impact on performance and productivity in the future.

This laboratory is developing the next generation technologies and products by combining our core technologies of each business unit and the innovative materials which are researched by the academy in the world.

Aiming to create new value!

Our R&D organization is not only development of material itself, but are tackling development of high value-added products and advanced technologies. NOF group is challenging to the new theme in the advanced fields (such as Life science) continuously, and creating of new solutions by combining our core technologies of business units and the fundamental technologies.



Oleo & Speciality Chemicals Research Laboratory (Oleo & Speciality Chemicals Division):

Focusing on application researches mainly for oils and fats and their derivatives, surfactants, macromolecules, the Oleo & Speciality Chemicals Research Laboratory is approaching from various angles and developing high-function and high-value-added products in the fields including resource, environment, energy, healthcare, information and electronics.



Functional Chemicals & Polymers Research Lab. (Functional Chemicals & Polymers Division):

In this laboratory, novel high performance polymers and advanced materials are being developed with the technologies from synthesis, analysis, polymerization and evaluation of organic peroxides.



Research and Development Department (Explosives & Propulsion Systems Division):

The laboratory is now promoting R&D activities to gunpowder, explosives, and solid propellants, exploring new areas, and setting up international cooperation focusing on the future globalization. The Kamioka Test Center has a test facility built in the tunnel to secure safety of the surroundings.



Functional Foods Research Laboratory (Functional Foods Division):

Based on technologies regarding oil and fat processing, emulsification, nano-emulsification and micro-encapsulation, functional utilization of emulsifiers and enzymes among others, and functional lipids including DHA, the laboratory is endeavoring to develop "safer and more trustworthy" products including edible oil and fats, functional food and enteral nutritional products.



Life Science Research Laboratory (Life Science Products Division):

Based on MPC polymer which is core biocompatible material, this laboratory engages in research and development to apply its polymer for medical products regarding eye-care, skin-care, oral-care, medical devices, or diagnostics.



DDS Research Laboratory (DDS Development Division):

This laboratory engages in research and development to apply advanced technologies, as well as PEG derivatives, phospholipids, and novel DDS materials in the field of DDS.



Display Materials Research Lab. (Display Materials Division)

Developing display materials-related products embodying the foremost of NOF's technology.



Nippon Koki Co., Ltd., Shirakawa Plant, R&D Department:

This company has developed many types of gun ammunitions for defense use. The company is now emphasizing development of products such as industrial explosives and precision devices including automotive safety devices. Based on these high technology accumulated through years of experiences, the company is now concentrating on the product development of the new security field to cope with the crime prevention, which are expected from various areas.



NiGK Corporation R&D Department:

This company has developed many new products using its own technology based on wide range of expertise such as chemistry, electrical and mechanical engineering, control technique and machinery.



NOF METAL COATINGS ASIA PACIFIC CO., LTD. Technical Section:

This company has been developing anti-corrosion agents for automotive parts, etc. and has led other companies in marketing high quality chrome-free anti-corrosion agents.



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Data provided in January 2019.K③① (A)