Innovation for Customers

History of Technological Innovation

The Nitto Group has produced countless new technologies based on our four core technologies and has created various products by combining these technologies since 1918, our foundation year. Furthermore, we have developed our business by applying the products and technologies which we have developed to various fields.

1918 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020

Tape

- 1918 Electrical insulating varnish cloth
- 1921 Linotape
- 1946 Friction tape
- 1951 Vinyl tape
- 1962 Paper adhesive tape
- 1974 Sealing material “NITTO EPTSEALER™”
- 1983 “COLOCOLO®”
- 1985 Reinforcing material “NITOHARD™”
- 2000 Vibration-damping material “LEGETOLEX®”

Double sided tape

- 1964 Double sided adhesive tape
- 1995 Thermal release sheet “REVALPHA™”
- 2002 Low-VOC double sided adhesive tape
- 2005 Strong double sided tape “HYPERJOINT®”

Surface protection

- 1961 Surface protection vinyl sheet “SPV®”
- 1992 Protective film for automobile
- 1998 Protection film for polarizer “E-MASK®”

Polarizing film

- 1975 Adhesive polarizing film
- 1982 Automobile application
- 1989 Retardation film for LCD
- 1996 High brightness polarizing film
- 2004 Polarizing film for large screen LCD TV
- 2007 “Roll to Panel®”

Medical use

- 1967 Medical adhesive sheet
- 1978 Antiphlogistic (Steloid tape)
- 1983 Transdermal patches
- 1994 Surgical tape “Yu-Ki Ban™”
- 2005 Polymer beads for nucleid acid synthesis

Fluoroplastic

- 1961 Fluoroplastic product “NITOFLON®”
- 1987 Polyethylene porous film “BREATHRON™”
- 1995 Fluorine resin porous film “TEMISH®”
- 1998 Pressure control parts “CAPSEAL®”

Sputtering technology

- 1984 Moisture-proof conformal sheet for EL
- 1985 Transparent conductive film “ELECRYSTA™”
- 2013 Energy saving window film “PENJEREX®”

Membrane

- 1973 Reverse-osmosis membrane
- 1981 Low pressure spiral-wound RO module
- 1994 Seawater desalination RO membrane module
- 1998 Capirally UF module
- 2008 High boron rejection RO module
- 2011 Sulfate ion rejection NF module

Insulation material

- 1952 Glass fiber cloth
- 1957 Casting and molding products
- 1964 Fiber reinforced plastic

Encapsulation resin

- 1965 Epoxy resin (EP/FP series)
- 1966 Semiconductor sealing epoxy resin
- 1983 Encapsulation resin for optical semiconductor
- 2003 Encapsulation resin for BGA

Tajiku fund

- 2015 “RAYCREA®”

Varnish

- 1924 Electrical insulating varnish
- 1951 Wire varnish

Polyimide

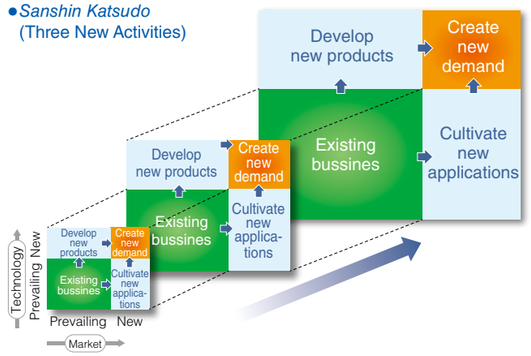
- 1973 Flexible printed circuit “NITOFLEX®”
- 1996 Film metal substrate for HDD heads

Suggesting New Possibilities

By creating new products, as well as developing new applications of our existing technologies and products after promptly considering our customers' problems, the Nitto Group has stimulated new demand. We call such activities *Sanshin Katsudo* (Three New Activities). At present, approximately 13,500 different products of ours are used in various industries, offering solutions to social problems.

Currently, in addition to existing business fields, we are promoting development of technologies and products which may be awaited anxiously by our customers, and seek to develop new possibilities, targeting the domains of Green (environmental concern), Clean (new energy) and Fine (life sciences).

●*Sanshin Katsudo*
(Three New Activities)



For Example — Information Terminals and Displays

Optical Film for Flat Panel Displays (FPD)

On FPD, without optical film such as polarizing film, retardation film or brightness enhancing film, characters and projected images are not visible. Film with Nitto's unique optical properties contributes to thinner, higher grade displays with increased energy efficiency.

Transparent Conductive Film

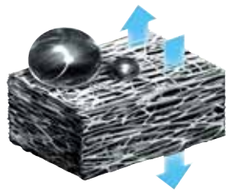
ELECRYSTA® transparent conductive film plays the role of a switch in touch panels by allowing in light while conducting electricity.

Structural Materials for Optical Products

We have a wide lineup of products, such as adhesive sheet, fixing optical film and surface protection materials to prevent scratching.

TEMISH® porous sheet (sound-permeable membrane)

TEMISH® is a water- and dust-resistant air-permeable porous sheet which allows the passage of sound while preventing the ingress of moisture and dirt. TEMISH® can be used on the mouthpieces of smartphones and wearable devices.



Nitto Awarded Display Component of the Year Award

Nowadays, thinner and more flexible displays are demanded, and it is an important challenge for us to make polarizing films thinner.

In such circumstances, Nitto has succeeded in developing a new, innovative ultra-thin polarizer. As recognition for this achievement, we were awarded a Display Component of the Year Award by the Society for Information Display at the 2016 Display Industry Awards.

Yukihiro Izuka, Director of Information Fine Materials (left) with presenter, Mr. Brian Berkeley

In this chapter, we introduce our new products and services, and those we aim to commercialize, as well as our existing products and services.

Green Clean Fine — Products and services in new domains that Nitto is putting emphasis on

Proposals for the Future! — Products and services which we aim to commercialize.

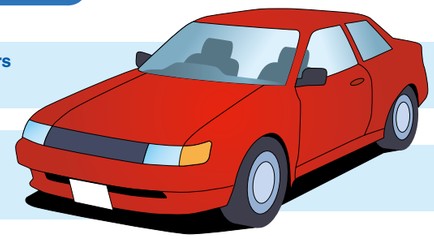
For Example — Automobiles

Waterstop for wiper motors
Foam sealing materials

Damping for power window motors
Highly functional damping materials

Water-proofing, dust-proofing and ventilation for headlamps
Internal pressure adjusting materials

Wire harness binding
Binding tape



Optical Transmission Cables

Proposals for the Future!

We have achieved high-quality bulk data transmission by combining our newly-developed film transmitting light signals (optical waveguide) with electrical circuit boards.

Electrical signals have become more commonplace in automobiles to improve safety and comfort. Nitto's optical transmission cables make it possible to carry signals for such applications at high data rate.

Film transmitting light signals

New Marketing Base in Munich, Germany

In order to advance the development of electronics and IT in automobiles and to swiftly meet the needs of the global market, we newly established a marketing base with the main focus on automobiles in Munich, Germany in July 2015.

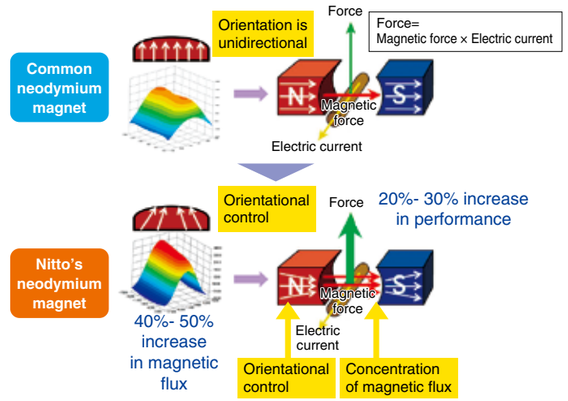
Name: Nitto Deutschland GmbH Munich Office
Location: 11 Parkring, 85748 Garching bei Munich, Germany

Clean — New Type of Neodymium Magnet

Proposals for the Future!

The neodymium magnet is used in motors, such as in automobiles, trains and mobile phones. By applying our organic/inorganic hybrid technology*1, we successfully developed a unique type of neodymium magnet featuring orientation control capability*2, which enables improvement in motor performance by 20 to 30 % compared to conventional motors, while also contributing to the miniaturization and lightweight manufacture of motors.

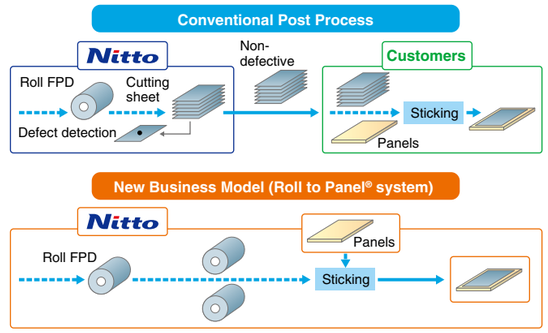
*1 Technology combining organic and inorganic elements at the nano and molecular levels
*2 Manipulating unidirectionally-aligned magnetic crystals



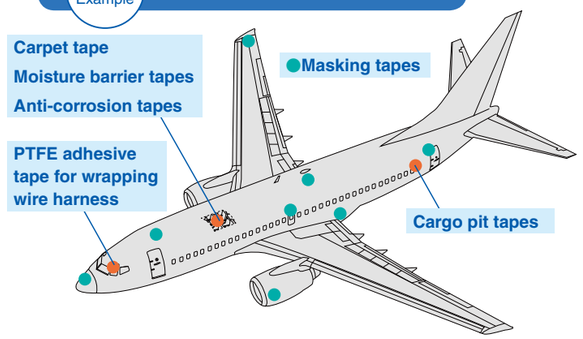
Roll to Panel®

In the past, we delivered optical film for FPD manufactured and processed at Nitto to customers, before customers assembled the FPD panels. In our new business model Roll to Panel®, we install equipment at customer plants, cutting and attaching optical film to FPD panels for our customers. This leads not only to reduction of processing and transportation costs, but also improvement of production efficiency.

In addition, we protect our business using the Roll to Panel® system by promptly acquiring the relevant patents globally and establishing a platform of patents.



For Example Aircrafts



Functional films for Aircraft Windows

Proposals for the Future!

There is a possibility that electromagnetic waves have an effect on electronic devices controlling the operation of aircraft. The Nitto Group is addressing development of film with not only heat shielding and heat insulating functions, but also able to shield electromagnetic waves simply by its application to windows. In practical use, such film will contribute to improvement of safety as well as comfort in aircraft.

Reflecting electromagnetic waves inside and outside of aircraft

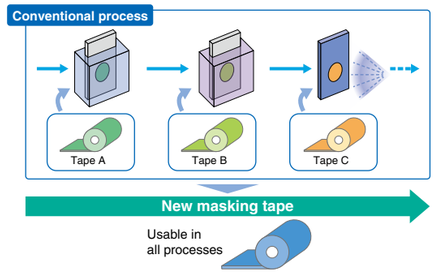
Proposals to Streamline Manufacturing and Operating Processes of Aircraft

Some masking tapes were previously used in the manufacturing process of metallic components. The masking tapes which the Nitto Group has developed require no reapplication, and therefore, contribute to improvement of productivity through a one-stop process.

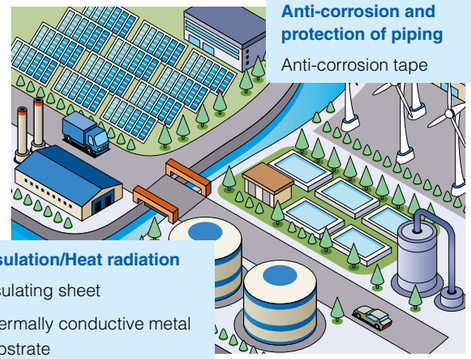
Furthermore, our anti-corrosion and moisture barrier materials for aircraft not only contribute to long-lasting aircraft frames, but also benefit maintenance operations, and are now being increasingly employed by major airlines.

In order to meet increasing passenger demand in the future, increasing aircraft production volume and operating efficiency will be required. Under the motto: “We help you to build faster, maintain easier”, the Nitto Group promotes development of new products.

■ One stop masking in manufacturing metal parts



For Example Social Infrastructure



Anti-corrosion and protection of piping

Anti-corrosion tape

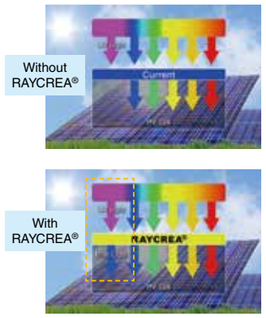
Insulation/Heat radiation

Insulating sheet

Thermally conductive metal substrate

Clean RAYCREA®

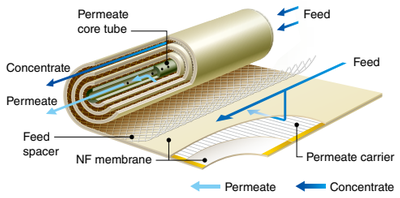
RAYCREA®, a wavelength conversion material applied to solar panels, converts UV light into blue light, which is harmless and available for power generation. It prevents deterioration of the panels without UV absorbers and improves power output by approximately 2%. RAYCREA® is highly durable and effective over a long time.



NANO-SW –Sulfate Ion-Rejection NF Membrane

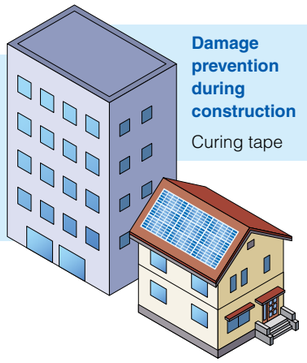
NANO-SW is a kind of reverse osmosis membrane. With its selective ion separation function, it is highly efficient in rejecting the sulfate ion contained in seawater. Taking advantage of this function, it has been used by offshore oil platforms since 2011 and used for the preprocessing* of infusion water in oil drilling.

■ Structure of Membrane



* Oil is extracted by injecting pressurized seawater into a reservoir. As sulfate ions contained in seawater can cause blockages in pipes, they need to be removed prior to injection.

For Example Housing, Building Materials and DIY



Roof and window sash waterproofing

Waterproof and airtight tape

Damage prevention during construction

Curing tape

Interior Decorating decolfa® Home Decoration

decolfa is an adhesive tape series for interior decorating. Such masking tapes used in wallpaper, window sheets and stick-on type mirrors and hooks make it easy to redecorate rooms.

Green PENJEREX® - Energy-saving Window Film with Solar Control and Thermal Insulation

PENJEREX® is a window film with high performance solar control and thermal insulation. It cuts solar radiation entering windows in summer and reduces heat loss in winter, to keep rooms comfortable. PENJEREX® allows energy saving in winter, which was hard to achieve with conventional window films. The Environmental Technology Verification (ETV) Program of the Ministry of the Environment, Government of Japan, has verified that PENJEREX® contributes to reducing power consumption throughout the year.

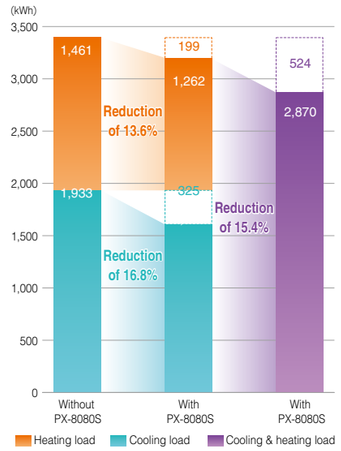
Summer

Reduction of 44% in solar radiation heat

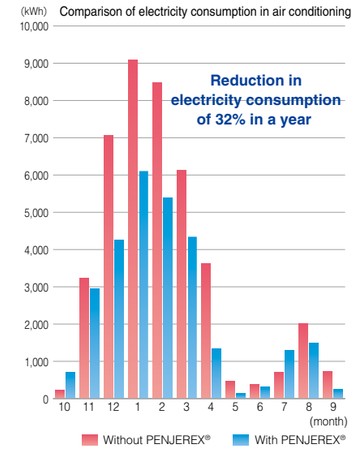
Winter

Reduction of 38% in thermal discharge

■ Energy-saving simulation of ETV (PX-8080S)



■ Results of demonstration construction at Nitto Tohoku Plant



For Example Agriculture

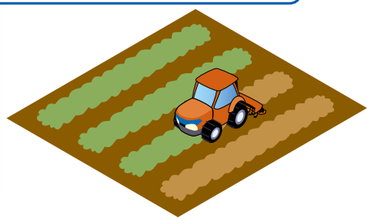
Green Me-del Sheet – Protective Sheet for Sweet Potato Seedlings

Me-del Sheet protects sweet potato seedlings from the wind, frost and chill and aims to take the backache out of seedling transplanting for farmers who have to work in a semi-crouching position all day. It is fixed firmly by simple rolling, as it has adhesive tape at either end, greatly reducing the number of hours worked.

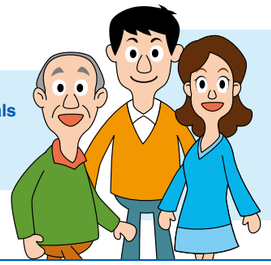
We have obtained yield feedback on crop yield improvements with Me-del Sheet and are further verifying its performance. We plan to develop Me-del Sheet overseas and aim to make a leap forward in fiscal 2016.

In conventional planting, straw and soil balls are placed on ridges by hand

Setting of Me-del Sheet. Planting is easier using a Raku-raku Roller



For Example Medical Services



Medical and sanitary materials

Surgical tape

Film dressing

Transdermal drug delivery patches

For asthma treatment

For local anesthesia

Fine Nucleic Acid Medicines

Nucleic acid medicines are pharmaceutical products produced from the structural components of DNA and RNA, called nucleic acid (oligonucleotide). Through direct action on genes and proteins, these medicines hold great promise for treating diseases such as cancer that were formerly difficult to treat.

The Nitto Group develops and distributes NittoPhase® high-performance polymer beads for the synthesis of nucleic acid medicine (essentially carriers for solid-phase synthesis), while also providing manufacturing of a number of drugs and various related services.

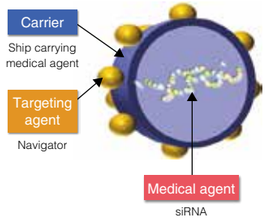
NittoPhase®

Fine Anti-fibrosis Drug with Molecular Targeting DDS Technology Platform

Proposals for the Future!

Drug delivery system (DDS) is a technology that steadily delivers drugs to an affected area. With the aim of industrializing the first drug discovery within the Group, we are engaged in the development of therapeutic agents for intractable diseases long-awaited by a great many patients using our DDS technology.

A drug for liver cirrhosis, which is at a pre-industrialization stage, is currently being tested for its safety and efficacy in patients, progressing steadily toward practical use.



Establishment of Nitto BioPharma, Inc. , Devoted to Drug Discoveries in the US

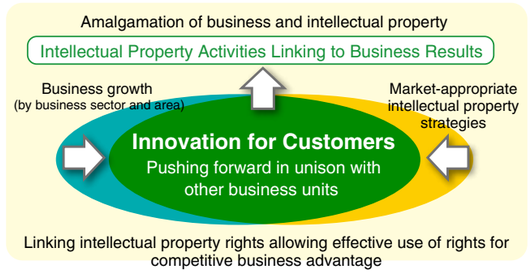
On January 11, 2016, we established a new company devoted to drug discoveries in the US. We are planning to relocate a development base to the north of San Diego where life science business is concentrated, further accelerating the industrialization of drug discoveries.

Protecting Business with Intellectual Property

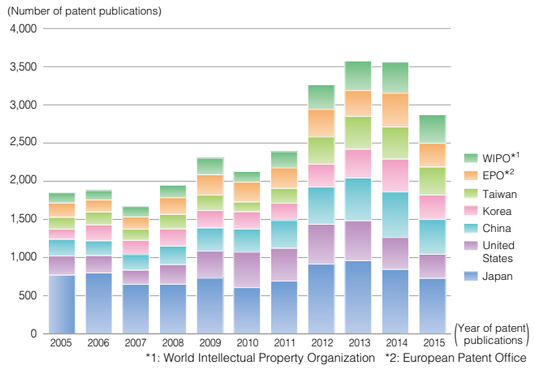
The Nitto Group implements optimal intellectual property activities according to our business strategy in order to achieve the industrialization and market penetration of technologies, services and products which we have developed. For example, we are adopting a new strategy, which includes such things as protecting business models like Roll to Panel® (refer to page 20).

Furthermore, the global application rate of the Nitto Group is more than 65%, which is relatively high (approximately 30% for the Japanese rate), and the globalization of our intellectual property activities continues to progress, in accordance with our business development. As recognition of such activities, the Nitto Group received a Thomson Reuters Top 100 Global Innovator award for the fifth consecutive year. The award is given to the most innovative corporations and research institutes.

Mr. Masaki Nagao, Thomson Reuters' Managing Director (left) with Mr. Hideo Takasaki, President of Nitto



■ Patent Publications of the Nitto Group (In Japan and major countries)

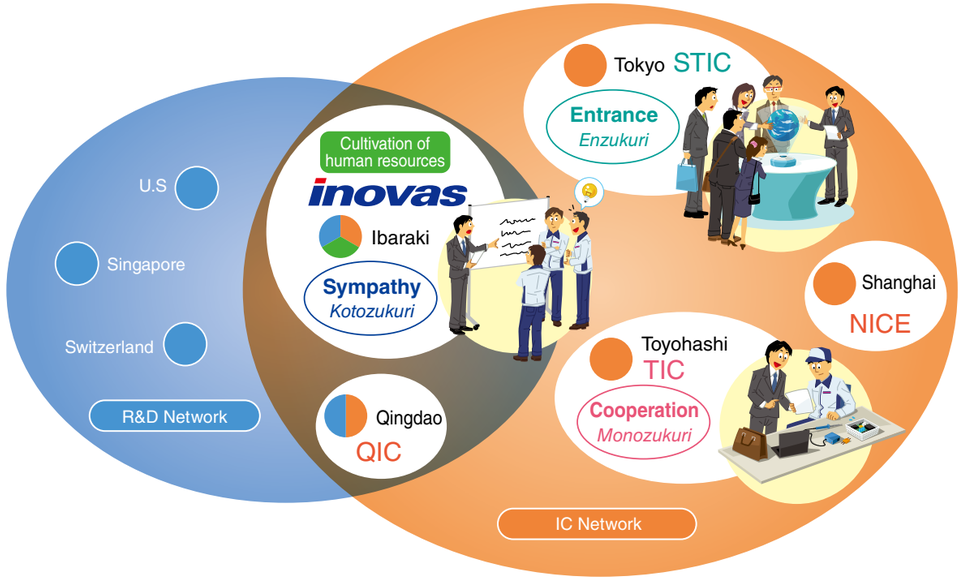


Focusing on the Future

The Nitto Group engages in the establishment of facilities for new value creation. In November 2015, we launched Season Terrace Innovation Center (STIC) at Nitto Global Marketing Center in Shinagawa, Tokyo. In addition, in March 2016 we established a facility known as inovas at Ibaraki Plant, with the three functions of the cultivation of human resources, research and development and the provision of an innovation center. STIC assumes the role of *enzukuri* (building relationships) as an entrance to the Nitto Group, while inovas aims to produce feelings of sympathy as a place of *kotozukuri* (creation of new value). Until now we had three facilities: Toyohashi Innovation Center; Nitto Denko (Shanghai) Innovation Center (NICE); and an innovation center (QIC) at Nitto (Qingdao) Technology Research Institute. At the Toyohashi Innovation Center we conduct *monozukuri* (manufacturing) in cooperation with our customers. With the addition of STIC and inovas, we have formed an innovation center (IC) network.

In addition, the Nitto Group has constructed a network for research and development centers among five countries, addressing research and development lead by local initiative.

In the future, by fusing these two networks, the Nitto Group will contribute to creating future value by working closely with to our customers.



Meeting of *Hito*, *Gi* and *Chi* Realizes Co-creation - Establishment of inovas

inovas was established as a place for cultivating human resources and technologies and innovating, in partnership with our customers. Fusing the innovation of *hito* 'person' (cultivation of human resources) with the innovation of *gi* 'technology' (research and development), leads to the innovation of *chi* 'knowledge' and provides our customers with surprises and impressions. Through repeated active dialogue and interchange with our customers and by allowing new ideas to take shape, we aim to realize our brand slogan, "Innovation for Customers".

HR cultivation zone

R&D zone

Innovation zone