Research and Development of the Nitto Denko Group

The Nitto Denko Group launches into various production projects by leveraging combined strength gleaned from accumulated expertise from over six hundred different types of technologies, all of which evolve from the following four fundamental technologies: “Adhesion Technology”, “Coating Technology”, “Polymer Function Control Technology” and “Polymer Analysis and Evaluation Technology”.

Four Fundamental Technologies

“Adhesion Technology”, “Coating Technology”, “Polymer Function Control Technology” and “Polymer Analysis and Evaluation Technology” are the four fundamental technologies of the Nitto Denko Group.

Adhesion Technology

By combining our diverse adhesion technologies and by utilizing new technologies, we create adhesive compounds ultimately suited to specific purposes.

- Adhesive Design Technology
- Lamination Technology
- Substrate Design Technology
- Adhesive Property Evaluation Technology
- Release Technology
- Adhesive Synthesis Technology

Coating Technology

We take pride in our coating technology, a process technology which is indispensable for producing film sheets with high functionality.

- Precision Coating Technology
- Drying Technology
- Substrate Transfer Technology
- Polymerization Technology
- Dispersion and Mixing Technology
- Bonding Technology

Polymer Function Control Technology

We design polymers and develop unique materials in order to fulfill a diverse range of required functions.

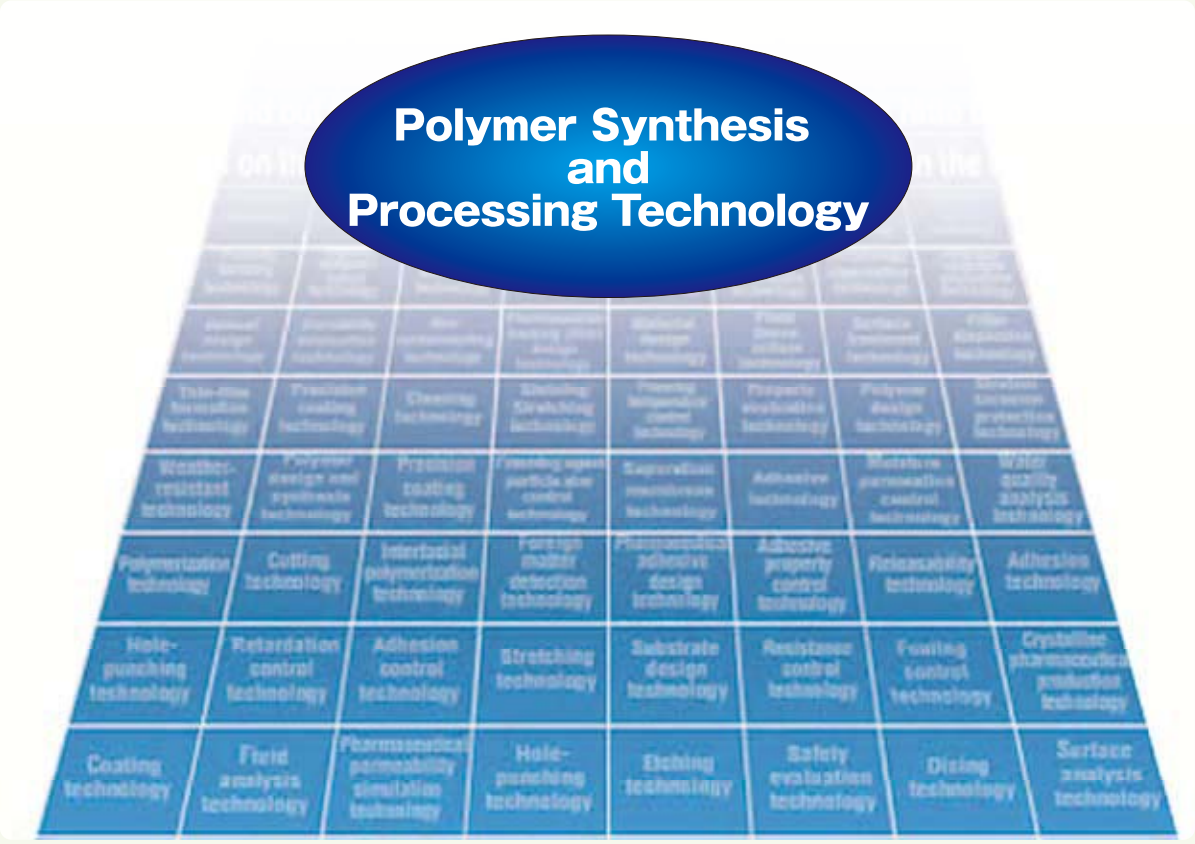
- Polymer Design Technology
- Surface Treatment Technology
- Photopolymer Technology
- Controlled Release Technology
- Polymer Blend/Alloy Technology
- Organic/Inorganic Hybrid Technology
- Drawing Technology
- Poration Technology

Polymer Analysis and Evaluation Technology

In order to deliver reliable technologies and trustworthiness we pay careful attention to everything from causes to outcome predictions, thus opening doors to the future.

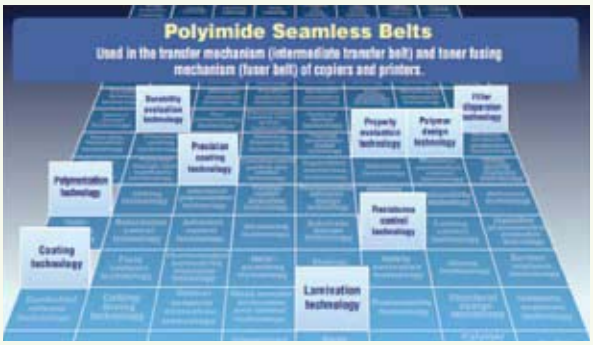
- Adhesion Evaluation Technology
- Practical Evaluation Technology
- Molecular Simulation Technology
- Real Property Simulation Technology
- Morphology Observation Technology
- Electric/Electronic Property Evaluation Technology
- Optical Property Evaluation Technology
- Acoustic and Vibration Characteristic Analysis Technology
- Safety Evaluation Technology
- Polymer Structure Evaluation Technology

The Nitto Denko Group creates a diverse variety of products through the combination of these technologies.



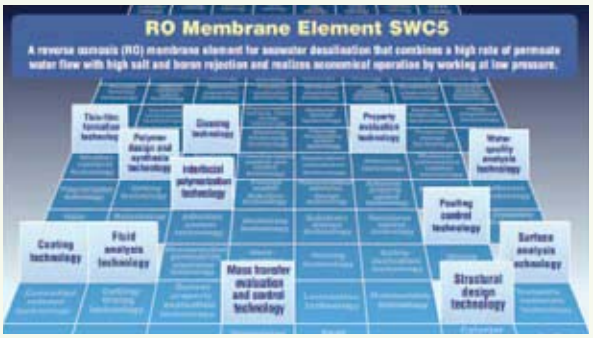
For example, polyimide seamless belts which are used for transfer parts (intermediate transfer belt) and fusing parts (fusing belt) of photocopiers and laser printers are produced from a combination of “Durability Evaluation Technology”, “Precision Coating Technology”, “Property Evaluation Technology”, “Polymer Design Technology”, “Filler Dispersion Technology”, “Coating Technology”, “Polymerization Technology”, “Lamination Technology” and “Resistance Control Technology”.

Polyimide seamless belts



Seawater desalination low pressure spiral RO membrane element SWC5 combines a high rate of permeate water flow with high salt and boron rejection and realizes economical operation by working at low pressure. It is an achievement of a combination of “Thin-film Formation Technology”, “Polymer Design and Synthesis Technology”, “Cleaning Technology”, “Interfacial Polymerization Technology”, “Property Evaluation Technology”, “Water Quality Analysis Technology”, “Coating Technology”, “Fluid Analysis Technology”, “Mass Transfer Evaluation and Control Technology”, “Fouling Control Technology”, “Structural Design Technology” and “Surface Analysis Technology.”

SWC5



Yu-Ki-Ban is a surgical tape for medical use designed to hold gauze dressings and tubes in place. Yu-Ki Perme-Aid is a medical film dressing used for holding catheters in place and as emergency wound dressing. These products utilize such technologies as “Cutting Technology”, “Pharmaceutical Backing (Film) Design Technology”, “Property Evaluation Technology”, “Moisture Permeation Control Technology”, “Stratum Corneum Protection Technology”, “Coating Technology”, “Hole-punching Technology”, “Pharmaceutical Adhesive Design Technology”, “Safety Evaluation Technology” and “Dicing Technology.”

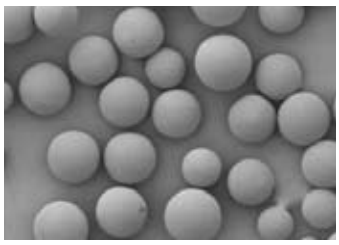
Yu-Ki-Ban, Yu-Ki Perme-Aid

New, High-performance Solid Support for Oligonucleotide Synthesis Developed

Nitto Denko Corporation and our U.S. research subsidiary Nitto Denko Technical Corporation have jointly developed a new, high-performance solid polymer support for oligonucleotide synthesis.

Nucleic acid drugs are a relatively new class of molecules that have in the past few years shown good promise for the treatment of various illnesses through the delivery of oligonucleotides such as antisense DNA and RNA into the human body. Among them “siRNA (small interfering RNA) drugs” comprising oligomers of double strand RNA have attracted much attention. As a result, a further expansion of the synthesis market for nucleic acid drugs, including siRNA drugs, is expected in the future. It is against this backdrop that we have developed the improved version of the existing NittoPhase® solid support, which can be loaded at significantly higher levels when compared to existing products on the market, making it possible to synthesize not only DNA but also RNA with high purity and high yield at the highest levels in the world.

We are currently marketing solid support under the trade name “NittoPhase®”, via another U.S. subsidiary of Nitto Denko, Kinovate Life Sciences Inc.



Magnified Image of the New Solid Support

Trends in Research and Development

Establishment of Two R&D Centers for the Creation of Technologies for the Next-generation

In recent years MEMS Devices have attracted much attention. Generally, MEMS (microelectro mechanical systems) refers to devices which integrate diverse functions on machineries, electron, photon and chemistry by using semiconductor microfabrication technology. Inorganic MEMS comprise the mainstream amidst the fierce global competition for miniaturization being carried out in the aim of lowering power consumption.

Alternatively, in October 2008 we established a center for organic electronic device development, the "Nitto Denko Asia Technical Center Pte. Ltd.", at Fusionopolis, Singapore's largest hub of multi-disciplinary R&D. In view of organic electronic device's role as a potential competitor against inorganic MEMS, we have positioned the center as a base for development of organic electronic device-related materials in South Asia.

Exterior View of Fusionopolis

The Center has cinched agreements with the A*STAR Data Storage Institute (DSI), A*STAR Institute of Materials Research and Engineering (IMRE) and Nanyang Technological University (NTU) to fund and carry out three research projects on the development of novel organic electronic sensing devices.

Through fusing our as many as 600 technologies with technologies of polymer waveguides developed in 2005 via DSI, IMRE and NTU's expertise in Complex Vibration Numerical/Experimental Analysis, Organic Electronics and Photonic Research, we are developing new high-sensitivity sensor products. Furthermore, we aim to expand our research scope to other fields beyond electronics.

Since 2000, large-scale NEWater plants at Bedok, Kranji and Ulu Pandan, have successfully adopted our Reverse Osmosis membranes, developed with the Singapore Public Utilities Bureau after the launch of Nitto Denko's NEWater wastewater recycling project in Singapore.

As a development base for this water treatment technology Nitto Denko established an R&D center, the "Singapore Water Membrane Technical Center" at WaterHub in Singapore, and is engaged in actual applications-development, centering our efforts on practical-use evaluation tests of Singapore water. Additionally, we aim to participate in new plant construction projects in collaboration with engineering companies from within and without Singapore.

Exterior View of WaterHub

New Holographic Display System/Method Featured in the science journal "Nature"

As we introduced in last year's CSR & Annual Report, our R&D base in U.S.A., Nitto Denko Technical Corporation has succeeded in jointly developing a rewritable holographic display with the University of Arizona.

A hologram is an image, which is used in films and the like as a means of displaying an object in three-dimensional form. Current hologram recording materials have the disadvantage that once an image is recorded, videos and the like can not be played as the image is not rewritable.

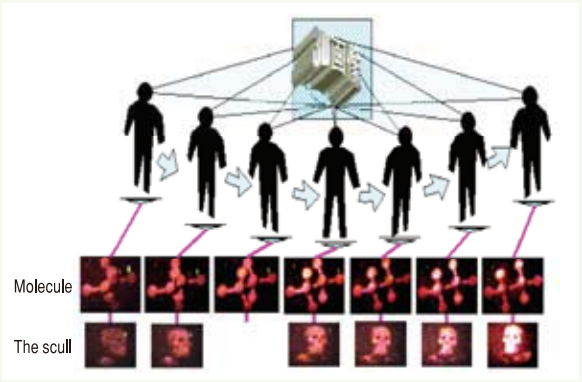
The photorefractive materials developed this time are rewritable recording materials. This material/system has the highest diffraction efficiency level in the world as well as excellent compositional stability. At the same time, writing speed was successfully improved by devising a special diffraction grating configuration.

Unlike the current photorefractive materials, we have made improvements in the chemical structure of the material and introduced special material layers, so that an image once recorded could be retained for a long time, while at the same time maintaining high image strength and fast writing speed. We succeeded in lengthening the period of time over which a recorded image could be retained until disappearance, from the order of the customary several seconds to several hours. The size of the photorefractive material-based sample developed is the largest in the world. The large-area display could be created both homogeneously and defect-free by capitalizing on our polymer processing technology expertise. The details of this system/method appeared in the science journal "Nature" (7 February 2008 edition).

1. Retentivity of Image

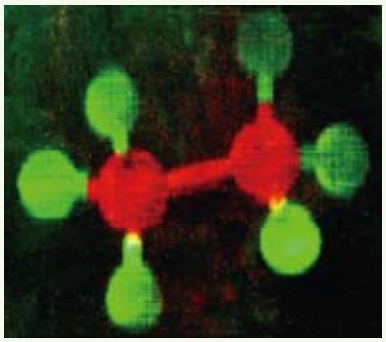
Attainment of Image Longevity

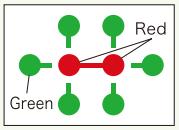
2. Rewrite Capability (Erasure possible at any time)



3. Defect-Free Large-area Samples

4. Capable of Two-color Display (Green&Red)





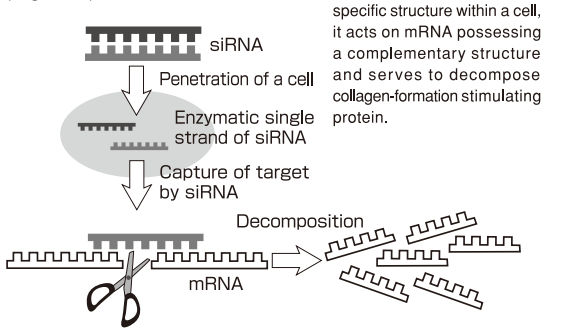
Breaking into the Field of Medicine with Polymer Technology

Our company's polymer synthesis technology is being applied to medical fields. Previously we had already conducted extensive bio-related materials research by applying our expertise in polymer technologies—for example, having previously developed a "biodegradable polymers carrier", and so on.

This time, the Japanese government has selected an R&D project being jointly pursued by us and a team headed by leading world medical researcher Professor Yoshiro Niitsu of Sapporo Medical University on an epoch-making Molecular Targeting Drug Delivery System (Molecular Targeting DDS), to receive Japanese government-sponsored financial and other assistance for fiscal year 2008.

The assistance comes under the New Energy and Industrial Technology Development Organization (NEDO)'s "Translational Research Promotion (TRP) Project," designed to bridge basic research and clinical research stages. The objective of the NEDO's TRP project system is the realization of swift practical application and popularization of medical technologies commensurate to levels of progress in scientific disciplines. It focuses on the four fields of Drug Discovery, Diagnostic Technology, Regenerative and Cell Medicine, and Therapy Equipment. NEDO's selection of our research theme "Novel Therapy for Fibrosis by the Use of Vitamin A- Conjugated Polymer—siRNA", was due to results of Professor Niitsu's research group at Sapporo Medical University demonstrating that the biodegradable polymer we developed was useful in liver cirrhosis treatment.

(Figure 1) Function of "siRNA"



When "siRNA" converts into a specific structure within a cell, it acts on mRNA possessing a complementary structure and serves to decompose collagen-formation stimulating protein.

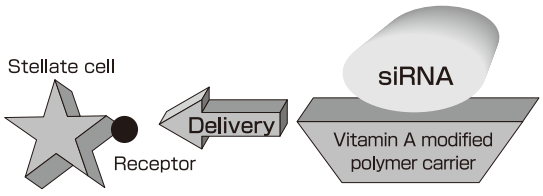
In this therapy, through administering siRNA (short duplex RNA which has the same sequence as a part of the target gene) the function of genes which promote the production of collagen is inhibited. This in turn is thought to delay the progress of cirrhosis(Figure 1). Until now liposome (lipid cachet) coupled with Vitamin A has been used as a carrier* to deliver siRNA to causative cells, but the parent carrier has been a liposome which has been difficult to measure. By converting from liposomes to the biodegradable polymer we developed, quantification will become possible and the realization of the development of molecular-targeted therapy will be made achievable. (Figure 2)

The actual development of the biodegradable polymer carrier at stake is being conducted by Nitto Denko Technical Corporation (NDT), while research is being jointly carried out by Professor Niitsu's team and Nitto Denko.

We anticipate that polymer carrier technology will become a new core of our medical business in the future.

* Carrier: a substance which combines with various substances in vivo and carries the bound substance

(Figure 2) Concept of "Molecular Targeting DDS"



Selectively delivers siRNA into a stellate cell through polymer carrier and controls fibrosis along with controlling excess secretion of collagen.