

Nitto Denko from the 20th into the 21st Century



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1 Nitto Denko in the 20th Century

Nitto Denko was founded in 1918 with the aim of establishing a domestic production of electrical insulation materials. At the time, a period of growth for the electrical industry, the majority of electrical appliance malfunctions were caused by insulation failures, and there was therefore a strong demand for the insulation materials on which product performance and life depended. Nitto Denko developed varnished cloth and varnished paper materials in response and by 1920 Nitto Denko products matched the performance of overseas-produced materials. The Nitto Denko platform technologies of polymer synthesis and coating grew out of these beginnings.

After World War II, the import of raw material oils and fats was interrupted, which hit the production of insulating coatings and cloths. We foresaw a strong demand for electrical insulation tape from the restoration of the electricity supply system and began to develop a 'black tape' using reclaimed rubber and cotton cloth, which was put on the market in 1946. However, due to inadequate production facilities and extreme material shortage, it took until 1949 for manufacturing steady quality products. Nevertheless, due to the eventual success of this product, Nitto Denko was established as a manufacturer of insulating materials, including tapes as well as varnished cloth and varnished paper.

In 1948, following the discovery of serious defects in our 'black tape', we undertook a range of improvements: we upgraded testing and inspection facilities, introduced a specimen storage system, and issued a test-result paper. This was the period when the groundlines of our product

development and reliability evaluation systems were laid.

In 1951, we launched vinyl tapes to replace the 'black tape'; we were supplying the greater part of domestic demand by 1954, when we began in-house production of vinyl film. Around this time, when the introduction of trade liberalization was about to open up the economy, we were seeking to add to our electrical insulation materials business by investigating openings into the market in industrial chemical materials, where expanded demand was forecast.

On the other hand, the spinning off in 1961 of the Maxell division, which had centered on production of batteries and sound-recording instruments and tapes, led to a reduction in our sales; new paths to expansion were therefore sought. It was against this background that we decided to use the technological and business foundation we had laid down on our way to becoming a specialist manufacturer of electrical insulation materials in order to break into the general industrial chemical materials market through development and commercialization of related new products.

We began to offer a varied range of new adhesive tapes produced by applying adhesive to a range of substrates, including not only Japanese paper, cloth, non-woven cloth, and metal foil, but also polyvinyl chloride (PVC) resin and the successively launched new materials of the time which followed it, such as polyethylene, polyester, cellophane, polypropylene, fluoroplastic, and polyimide. By processing the high-performance fluoroplastic material into tapes, tubes, films and moldings, we were able to respond to a series of user requirements. In the 1960s and 1970s, we introduced new technologies in the form of epoxy resin molding technology, diecasting technology and flexible printed circuit technology.

In the area of film manufacturing, we developed PVC calendering technology and polyethylene extrusion and inflation technologies to expand the scope of our product design activities. In addition, we sought functional improvements through introduction of porous film manufacture, establishing both dry and wet porous film production technologies, and developed a new function known as separation.

With a view to improving film function, we developed stretching and alignment technologies, which led to the emergence of a range of optical films typical of which are our polarizing films, and which made possible functions such as selective transmittance and reflectivity.

A new path of development opened with our creation of medical-use adhesive tape. This departure led into life science-related areas and products such as transdermal therapeutic patches, microbial pest control agents, and immunochromatography test kits. Meanwhile, the emergence of our system technology allowed us, to give two examples, to make the progression from tape applicator production to semiconductor production processing and barcode labeling system technology; and from membrane technology to membrane module technology (see Table 1).

Our development in the 20th century was achieved through active use of the new materials produced by advances in petrochemical science, and through combina-

tion of our basic capabilities in synthesis and coating with successive technologies. It was thus a period in which successive new inventions led to the creation of new value.

Our diverse new product ranges have come about through expanding of functions, for instance:

- Shut-off (electricity, water, impurities, vibration, noise)
- Connection (electrical, physical)
- Selective transmission and separation (impurities, moisture, ions, light)
- Diffusion (therapeutic drugs)
- Exchange (light and heat-based behavior)

Meanwhile, more sophisticated functions were sought through deepening of technology:

- Perfecting of technologies
- Addition of technologies
- Combination of technologies

For a representation of these trends, see Table 2.

Our achievements in the 20th century have developed from twin roots: our electrical insulation technology represents a strand of accuracy in our corporate culture, while our adhesive technology represents a strand of simplicity. A senior colleague has described this as follows:

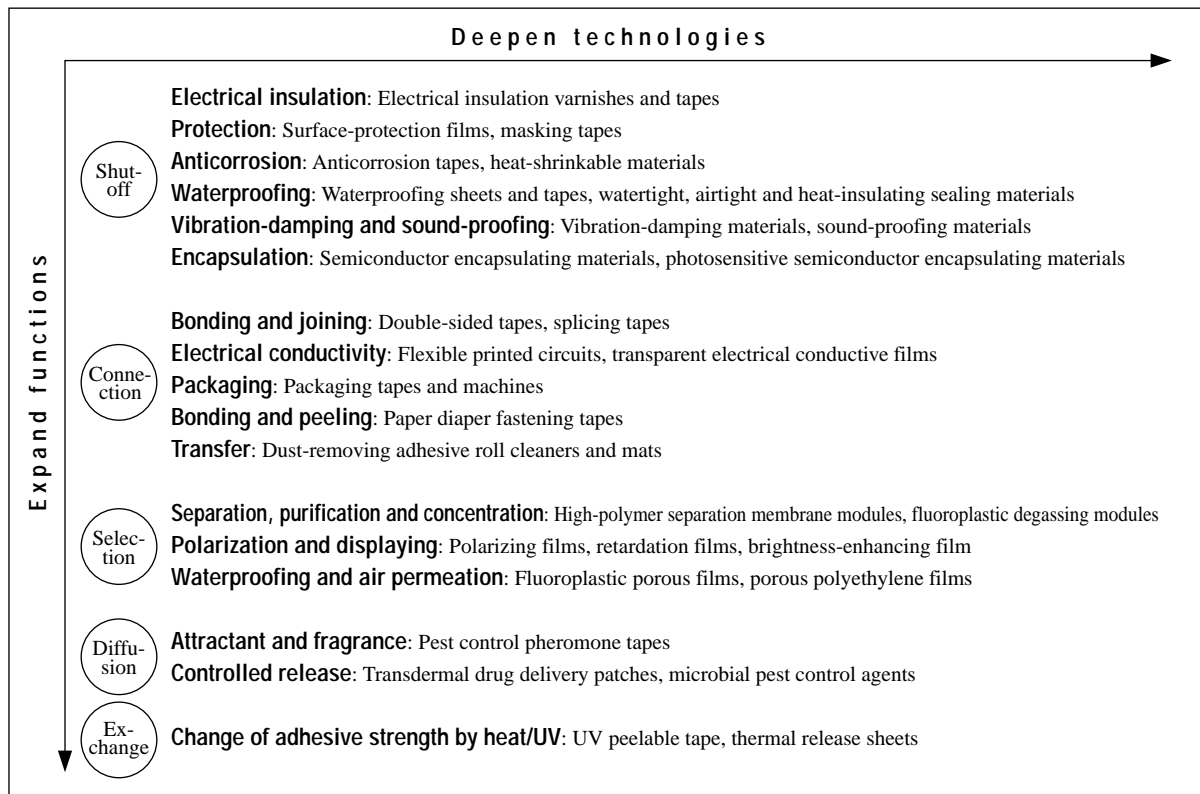
1. In order to meet the guaranteed performance requirement of electrical insulation materials, we turned our attention

Table 1 Evolution of main products and platform technologies

	1918	1950	1960	1970	1980	1990	2000		
Development of platform technologies	Synthesis	Varnish	Acrylic adhesive	Epoxy resin	Polyimide	Interfacial polymerization	Precision synthesis	Computer modeling	
	Coating	Coating	Thin-layer coating	Pattern coating			Multi-layer coating		
	Molding		Casting	Molding	Powder molding	Foaming		Precision processing	
	Film forming		Calendering	Extrusion	Inflation	Wet-membrane process	Porous film production	Stretch production	Multi-layer production
				Lamination	Surface treatment				
	Life sciences						Controlled release	Tissue culture	Microbial products
	System development			Tape applicators	Semiconductor appliances	Modularization	Immuno-chromatography kits	Software design	

product history	1918	1950	1960	1970	1980	1990	2000
	Varnished cloth Varnished paper Black Tape	Vinyl tapes Packaging tapes Electrical insulation products	Surface-protection films Fluoroplastic products Double-sided adhesive tapes Automatic packaging machines Semiconductor-encapsulating epoxy resin	Flexible printed circuits Sealing products Polarizing films High-polymer separation membrane modules	Fluoroplastic porous membranes Transdermal therapeutic patches Retardation films UV peelable tapes Thermal release sheets Polyimide belts	Reverse osmosis membranes for desalination Surface protection films for automotive coatings Barcode labeling systems Hard disk drive suspensions Brightness-enhancing film Transdermal therapeutic patches for asthma	

Table 2 Diverse product ranges through deepening of technologies and expanding of functions



to new materials, incorporated new technologies, and at the same time established a corporate culture of accuracy in which reliability was seen as the highest priority.

2. To contribute to labor-saving and rationalization for our customers, we established a culture of simplicity represented by adhesive tape which made work easier. As this element of our culture expanded, our position of always giving emphasis to the reliability ensured by our culture of accuracy won customer appreciation.

Our senior colleagues and predecessors at Nitto Denko deepened technology and expanded functions to give the world diverse product ranges, at the same time building within the company cultures of accuracy and simplicity. We entered the 21st century with a mission to discover our next dimension of development.

2 Nitto Denko in the 21st Century

Our aspiration is to lead the world in certain niche markets which give scope to our specialities and thus to achieve continuous growth. The key phrases in this ambition are becoming a technology-oriented company and

achieving globalization and flexible management. Accordingly the three tasks for our research and development activities are the following:

1. Creation of new core business
2. Development of environment-friendly technologies to expand business opportunities
3. Development of profitable new products

The new core business mentioned in the first of these we intend to seek in the so-called 3Es, the high-growth areas which we see as our main industrial sectors: Electronics, Energy and Ecology. New business in the electronics and energy sectors is likely to flow from: the development of the optical film technology which has grown into one of our main businesses; flexible printed circuit technology; and the electrical and electronic technology which were our origins. Potential for new business in the ecology sector is expected to flow from development of our life sciences sector. Our new core businesses will essentially be developed on the technological foundation we have established over time, but with technological reinforcement actively procured where necessary.

The second of the R&D tasks is in response to environmental and societal necessity. In the 21st century, our position will be to take a positive approach to the issues of finding alternatives to fossil fuels, reduction of energy consumption and easing of environmental load, with a view to creating business opportunities. Reduction of solvent use and development of solvent-free and PVC-free techniques and energy-saving product design are among the issues which we intend to successively tackle and resolve.

The third task, to develop profitable new products, requires the backing of outstanding technology and innovative production processes. Products developed in the preceding three-year period are considered new products, and the company-wide goal is to make these products count for at least 35% of total sales. To this end, our R&D, production and sales departments are making concerted efforts to identify customer wishes, and to establish technologies and production processes which will meet those wishes. Looking at the regional aspect of operations, we are implementing globalization by making sure that development and production are each carried out at the most suitable location in our global network.

To successfully complete these tasks, it is important to apprehend customer wishes and trends in the world at large as quickly as possible, and, using our basic technologies, to complete development of new products ahead of our competitors. Through this activity, we hope to continue as a Technology-Oriented Company enjoying customer confidence.

In order to achieve the functions which customers require, we use rich resources of imagination to outline an ideal, and work towards its realization with our resources of creativity. Our seniors and predecessors, by using imagination and creativity to successively achieve the functions required by customers, achieved an expanding of functions.

The development of technology has offered us new tools and has enhanced our wellbeing. Nevertheless, we now need to stop and think what effects this process has had. The innocent age when Mother Earth's embrace encompassed all our activities and there was no need to think of their consequences belongs to history. So massive is the scale of our impact that the sustainability of the Earth itself is threatened, and a question hangs over whether our children and grandchildren will be able to enjoy the Earth's resources.

Against this background, in order to remain a company which is of value to society, we need to decide what are the things that are really important to our wellbeing, pursue functions which will allow their realization and then expand those functions. What is required of the technology of the future is not only excellence, but that it take account of the value and the loss implicit in the functions it provides.

When we consider what is required of research and development these days, the most important thing is, I think, imagination. The results achieved by realizing a certain function need to be calmly judged by applying the imagination. These results should not be considered as a single point, but should be thought of on a time axis tending toward maximum value and minimum loss (see Fig. 1).

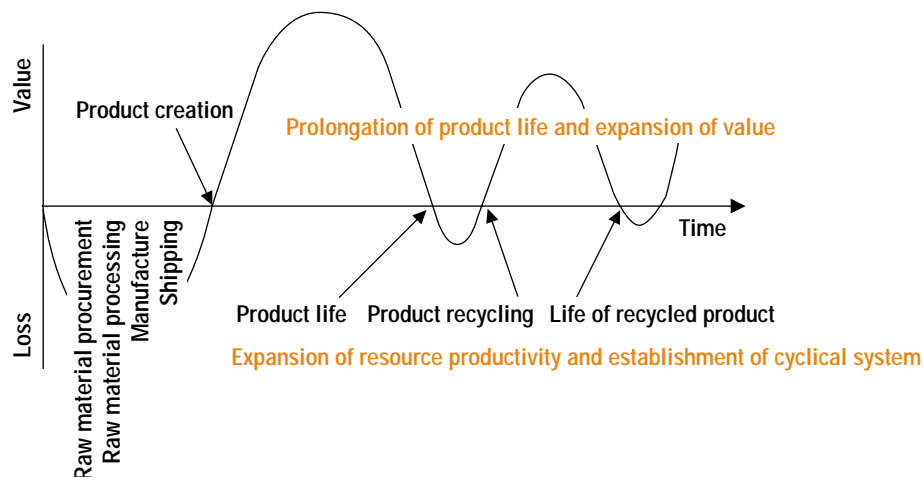


Fig. 1 Change along time axis of value and loss

Among the things which were lost in the process of achieving the wealth of the 20th century are many things we are unaware of because we never experienced them. The environmental problems which we experienced at the end of the 20th century taught us many lessons; there is ample material there for our imaginations to work on. The most basic thing is perhaps to maintain an attitude of compassion. Given this as a precondition, what is needed when aiming to achieve a sound corporate structure tuned to continuous growth is a strong will and the resources to back it.

As we enter the 21st century, we recall our founding mission, the hardship of the immediate postwar period, and the determination and continuous effort of our predecessors, who took the decision in the 1960s to break out of the mold

of specialist manufacturer of electrical insulating tape; learning from these episodes in the past, we feel inspired to become involved in creating something new and of value. The corporate culture we will create in the future will carry on the traditions of honoring accuracy and simplicity, although what new watchword will describe it we do not yet know.

I believe that pursuing technology towards the ideal which will bring mankind true wellbeing will make us a company of value to society in the 21st century, too, and that this will naturally lead to the creation of a new Nitto Denko corporate culture.

In the new century, we hope to carry on giving shape to that ideal in partnership with our customers.