# Japanese Textiles Support World Fashion Industry

*By Hirai Katsuhiko*

## I. Introduction

Imports accounted for 85% of Japan's textile goods market as calculated on a thread basis in 2005. Notably, 90% of clothing sales in Japan were imports in terms of the number of clothing items, and 90% of such imports were from China. This shows that the Japanese market has been swept by imports, particularly Chinese-made goods, and that Japan's domestic textile industry is in an extremely tough situation. But in terms of value, imports' share in Japan's clothing market was about 60%, indicating that domestic products have seized a relatively large share compared with that in volume terms. This apparently shows that Japan's clothing market is divided into two segments. One is the low-priced product market, or the so-called volume zone. The other is the medium- and high-priced product market, called the small-lot zone, which needs makers' quick response to market trends. Japan's domestically made products appear to have seized the latter market segment.

Needless to say, the high-end clothing market, which forms the core of the fashion industry, is supported by the industry's total capabilities of software and hardware encompassing the design, textile and apparel fields. Among other things, the textile field is the linchpin of the fashion industry that helps display its soft power. Japanese-made textiles are highly competitive and stand out in the world.

Backed by its technological and product development capabilities ranked at the top of the world, Japan's textile industry has an advantage in the field of high-quality and high-functional products. In fact, the Japanese textile industry's technological and development capabilities provide it with the main source of its international competition. Rival countries are fast catching up with Japan. Japan's textile industry is required to continue its uninterrupted R&D efforts to stave off competition from rivals, challenge technological breakthroughs and aim at developing higher-level technologies. With these advantages, Japanese products can secure a sizable share and survive in the world's high-end clothing market.

Following is an overview of Japanese-made textiles which support Japan's fashion industry.

## II. Overview

As mentioned above, Japanese textiles are backed by the high-level technological development capabilities of manufacturers. They are characterized by a combination of materials, weaving and knitting, and dyeing. This means best-suited weaving/knitting and dyeing are applied to materials to bring out their features to the maximum. This can be made possible only with cooperation between thread makers and textile producers. Regrettably, Japan's textile-producing districts have become exhausted under import pressures in recent years. But there have appeared some fresh moves toward reactivating textile-producing centers such as formulating clusters of thread makers and textile producers, paving the way for steadily rehabilitating the textile industry.

The Japanese market is characterized by the growing individualization of clothing and the rising sense of environmental preservation. Amid such changes in awareness, some textile-producing regions have drawn attention for their new technological trends. Among them are the high-mix, small-lot and short-cycle production system that covers processes from weaving and knitting to dyeing and sewing, and technologies on wastewater-free dyeing in supercritical carbon dioxide. Notably, the former system permits production of trendy products in the volume needed and in required time based on consumer needs, in sharp contrast to the conventional pattern of mass production and mass consumption. The recent development of computerized control of customer information is helping make this system possible. The ultimate goal is to win an order for a single ready-made article, not a custom-made one.

High-functional textiles were first used for new functional sportswear for Olympic athletes and for uniforms that require special functions. They were later used for general clothing such as casual wear. Among them are lightweight and heat-retaining fleece wear and easy-to-move comfort clothing made of stretchy materials. Demand for clothing has changed from quantity to quality keeping pace with improvement in the quality of life. Furthermore, in Japan recently, consumers have become sensitive to purity, health and the environment. As a result, there have appeared such materials with psychologically comfortable effects as those shielding ultraviolet rays, chilly to touch, useful for moisture retention or whitening, and providing healing effects.

Meanwhile, attention has been focused recently on the polylactic-acid fiber whose environmental burden is low. Polylactic acid is produced from such biomass feedstock as corn starch and sugarcane. Bacterial fermentation is used to produce lactic acid, which is polymerized into polylactic acid. Carbon dioxide emissions from the incineration of used products made of biomass resources are considered not to increase the concentration of carbon dioxide in the air. This is because the carbon dioxide emitted from such products was originally absorbed from the air through photosynthesis by the plant used as their feedstock. This condition is called "carbon neutral." Polylactic acid can be called one of global-scale, resource-recycling materials and has begun to win market appreciation for its contribution to environmental preserva-

Chart 1:
Life cycle of polylactic acid fiber (carbon neutral) (courtesy of Toray Industries)

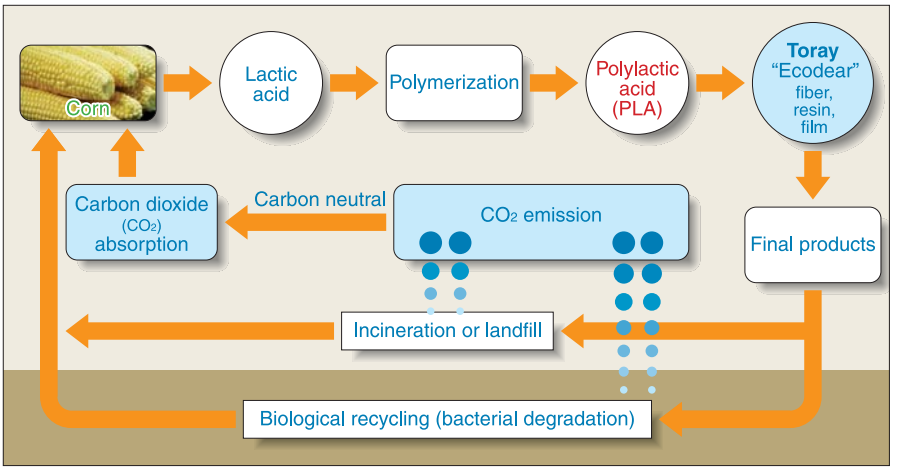
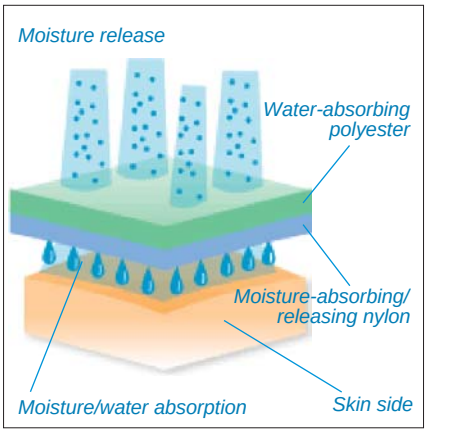



Chart 2:
Unitika's "HYGRA-LU" (courtesy of Unitika Ltd.)




Mechanism chart for moisture/water-absorbing & quickly drying material

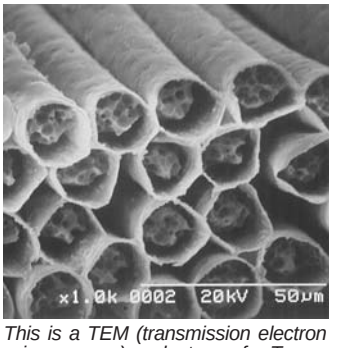
tion. Thus, carbon-neutral synthetic fibers produced from biomass resources as their feedstock will draw more attention from the viewpoint of global environmental protection. *(Chart 1)*

Nanotechnology-applied fibers have also drawn attention. The technology enables full control, on the nano scale (less than 100 nanometers), of the portion of a fiber to be processed, the use of a chemical agent for processing, and the fiber structure. The technology creates new textile functions and greatly improves features, functions and the scope of application, compared with conventional processing. This is called nano-scale processing. Under the technology, each single fiber is evenly coated. Products with functions such as anti-pollen adhesion, water absorption and anti-static functions have been developed. *(Photo 1)* A nylon nanofiber made of more than 1.4 million filaments, each measuring only tens of nanometers in diameter, has also been developed, contributing to the birth of a variety of products for multipurpose applications based on the characteristic superficial dimension and other features. *(Photo 2)*

## III. Trends of Technological Renovations

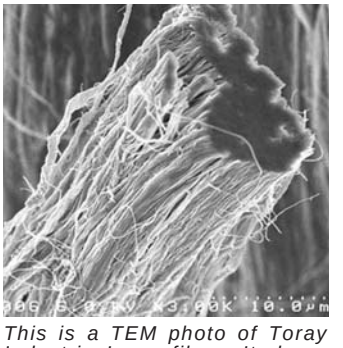
Japanese textile makers have achieved various technological renovations in recent years. The Environment Ministry has since 2005 promoted "Cool Biz" and "Warm Biz" campaigns as part of efforts to fight global warming and save energy. It has set the recommended summertime office temperature at 28C under the Cool Biz drive and its winter equivalent at 20C under the Warm Biz campaign. Textile makers have come up with materials suiting clothes for such purposes in response to the summer and winter anti-global warming campaigns. Following are examples of such materials.

Photo 1:
Example of nano-scale processing




This is a TEM (transmission electron microscope) photo of Toray Industries' "NANOMATRIX." It shows polyester filaments in a filmy state after being melted.

Photo 2: Example of nanofibers



This is a TEM photo of Toray Industries' nanofiber. It shows nanofibers in a bundled state.

### 1. "Cool Biz" materials

**(1) Moisture- & sweat-absorbing, quickly drying materials**

Chemical components of fibers mainly determine the level of their moisture-absorbing capability. Their water-absorbing capability improves under the capillary phenomenon caused by enlarging the surface area per fiber unit mass (or making a fiber thin, deforming cross sections, cutting gashes on the lateral side of a fiber, or making the fiber structure porous). Synthetic fibers are inferior in moisture absorption as a whole. But there are reformed synthetic fiber materials whose moisture-absorbing capability has been improved. At the same time, some materials excel in water-absorbing capability. Synthetic fibers with improved moisture- and water-absorbing capabilities release extra moisture absorbed and thus become quickly drying materials.

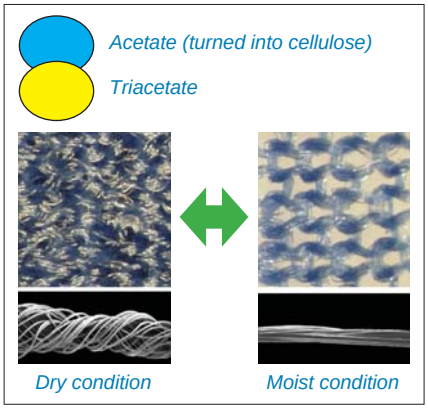
One example of moisture/water-absorbing and quick-drying materials is a mixture of reformed nylon with improved moisture-absorbing and -releasing capabilities and "heteromorphic cross-sectional polyester" with improved water-absorbing capability. The mixed material quickly releases sweat absorbed, curbs discomfort inside clothing, and maintains comfort. *(Chart 2)*

**(2) Highly breathable materials**

Among examples of highly breathable materials enabling fabric to have improved breathability and water-

Photo 3:
Toray's "kazetoru-shirt"
(courtesy of Toray Industries)


Photo 4: Mitsubishi Rayon's "VENTCOOL"
(courtesy of Mitsubishi Rayon Co.)




absorbing capability is one that uses heteromorphic cross-sectional polyester as woof and unevenly surfaced cotton yarn as warp. This particular type of polyester excels in water-absorbing and quick-drying capabilities, while the breathability of cotton yarn is improved with a patterned indented surface. The breathability of fabric made of the mixed material is five times larger and its water-absorbing capability seven times larger than that of a shirt made of a mixture of conventional polyester and cotton. *(Photo 3)*

**(3)Breathability-controlling materials**

One breathability-controlling material is a thread made from woven and knit triacetate and acetate (diacetate) produced through the composite spinning of the two synthetic fibers, with the acetate (diacetate) portion deacetylated and made into cellulose. Cellulose parts of this thread contract and crimp when the moisture level around it is low, curbing the breathability of fabric. If the moisture level is high, cellulose parts turn normal and lose the crimps, allowing the fabric to recover breathability. *(Photo 4)*

Photo 5:
Teijin's "AEROTOP"
(courtesy of Teijin Ltd.)

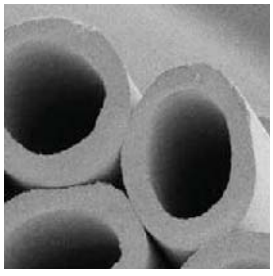
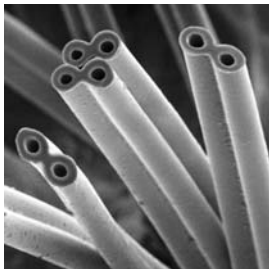
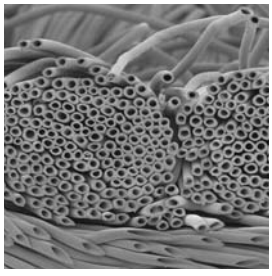


Photo 6:
Asahi Kasei Fibers' "TWINAIR"
(courtesy of Asahi Kasei Fibers)



Hollow fibers

Photo 7:
Toray's "CEBONNER SUMLON"
(courtesy of Toray Industries)



One of the fiber components melted to make the fiber hollow

## 2. "Warm Biz" materials

**(1) Light, heat-retaining materials**

A rise in the air porosity of fiber leads to production of a light-weight, heat-retaining material. Fiber with air porosity is called hollow fiber. There are two different methods to produce hollow fiber. One is to produce hollow fiber from the start. *(Photos 5, 6)* The other is to produce fiber made from two components, weave or knit the fiber into fabric, and melt one of the components to make the fiber hollow. *(Photo 7)*

**(2) Heat-generating materials**

Among these materials is one containing substance that absorbs sunlight and changes it to heat energy (zirconium carbide is an example). Such a substance is kneaded into fiber. The surface temperature of clothing made of such textile materials goes up as the substance contained absorbs sunlight and turns it to heat. Besides the sunlight-to-heat function, the heat-retaining capability of clothing is improved by an added function of allowing heat from the human body (far-infrared rays) to bounce back from the inner surface of clothing, thus keeping the heat inside. *(Photos 8, 9)*

Photo 8: Unitika's "THERMOTORON"
(courtesy of Unitika Ltd.)

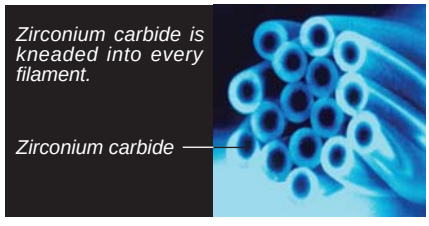
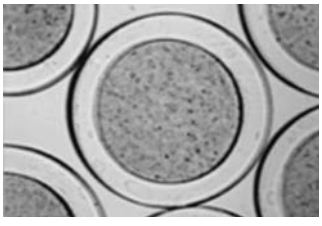



Photo 9: Black silica-kneaded fiber used for Kuraray's "MICROWARM" (courtesy of Kuraray Co.)



## IV. Conclusion

The above are limited examples of innovations achieved by Japan's textile industry. The industry has made full use of its yarn-making technologies, including those for heteromorphic cross-sectional fiber, ultrafine fiber, composite fiber and polymer blend, to develop a variety of fibers and textiles. The world's fashion industry is expected to be further diversified from now on. Backed by its high-level technological and development capabilities, Japan's textile industry is certain that it will be able to meet needs of the global fashion industry.

Moreover, the use of fibers is expanding not only for clothing but for businesses like automobiles, aircraft and construction materials as well as for homes. Japan's fiber and textile industry ranks at the top in the world not only in the fashion field but in all other fields. Its power is based on its technological and development capabilities.

**Editor's note:**

The product names in quotation marks are the trademarks of the companies concerned.

*Hirai Katsuhiko, senior advisor, Toray Industries Inc., also serves as chairman, the Japan Committee, Japan-South Korea-China Business Forum, Nippon Keidanren (Japan Business Federation).*