"I Want to Produce Fibers in the Tens of Thousands without Breaking, Enough to Circle the World Six Times"

Director,Technology Management Dept.
Nonwovens Division, Health Care Business Sector, Mitsui Chemicals, Inc.
Kenichi Suzuki

Soft and strong nonwoven fabrics

Mitsui Chemicals commands the highest-level technology in Asia for sanitary-use high-performance nonwoven fabrics, such as those used in disposable diapers. Kenichi Suzuki is the person who maintains quality as technology supervisor. Wanting to engage in work that leads to business, he applied for a departmental transfer in his third year with the company. Since then, he has continued to pursue new functionality as a specialist in high-performance nonwoven fabrics that improve the quality of life.

Their width is a fraction of that of a human hair. Shining, semi-transparent fibers spin out at high speed, hundreds or thousands at a time. Extending a hand toward them, one feels a wind blowing strongly downward in the direction of the fibers' flow. The fibers quickly form a cotton candy-like mass and pile up in the hand (photo, bottom left).

"This is a small prototype machine, but our goal is to run mass production machines, with a fiber-spinning breadth of several meters, continuously for a year," says Kenichi Suzuki, Technology Unification Group Leader in the company's Nonwovens Division, in relaxed tones. The difficulty of manufacturing fibers is difficult to appreciate by sight alone, yet trouble-free operation of mass production machines calls for a whole new world of production technology.

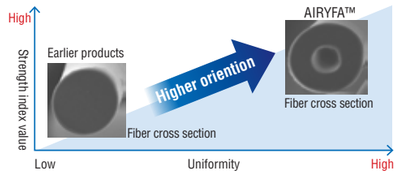
Nearly all evaluation members are women

Mitsui Chemicals leveraged its proprietary polyolefin spinning technology to develop AIRYFA™, the world's first flexible nonwoven textile with high strength, and launched the product in May of 2017. Nonwoven fabric is material in the form of a sheet of fibers that intertwine without weaving. AIRYFA™, which takes its name from "airy" and "fabric," features both softness and strength. It is used in thigh side gathers in disposable baby diapers sold by major manufacturers of sanitary goods.

Suzuki explains, "Nonwoven fabrics have gradually improved. To achieve gentleness to skin, two things have recently become important in disposable baby diapers: a softness felt when the material directly touches skin, and a fit that maintains softness during movement."

Mitsui Chemicals quantifies and evaluates the sensory expression of "gentleness to the skin" using a "softness index" it developed on its own.

"The way a mother rubs a baby's bottom was very important in this. The members in charge of the evaluation system are nearly all women," says Suzuki. Women appear to have a clearly keener sense when it comes to touching skin.



Compared with a cross section of a fiber used in conventional nonwoven fabrics, the AIRYFA™ fiber cross section reveals a hollow interior. The hollowing rate is 20%. This hollowness creates a softer feel than do earlier products when the fibers are bent. The product also ensures high tensile strength in the direction of the fibers. AIRYFA™ makes use of fibers that combine high softness with high strength.

You can't do new things without conviction

How did the development of the nonwoven fabric AIRYFA™, with its opposing qualities of soft and strong, come about?

"Over time, we had developed and built up a variety of products and technologies that included crimped fibers nonwoven fabrics made with coil-shaped fibers. For AIRYFA™, we modified the spinning nozzle and other parts to give the fibers a thin-walled hollow structure for softness, and aligned the fibers' molecular chains in the same direction to achieve high strength."

With a hollowing rate of 20%, the fibers also reduce the use of raw materials. The company achieved nonwoven fabric that is not only "gentle to people" but also "gentle to the environment."

The problem is the mass production process, in which the nozzle width extends to several meters. Tens of thousands of fibers are spun at once, and even one must not break.

The reason is that nonwoven fabric is pulled as it is produced, and the spot where fibers have broken can rip open.

"What we're aiming for is a length about six times the circumference of the earth, or in terms of time, continual production for a year without even one breakage of fibers," explains Suzuki.

Nonwoven fabric, made through localized thermal bonding of tens of thousands of ultra-fine (10- to 20-micrometer diameter) fibers into sheet form, requires exacting production technology. Production conditions can vary with changes in temperature and humidity.

Suzuki says his motto is "Stick to convictions." "When we attempt something new, we're questioned over whether we can really do it, and we can't say no. We can generally tell the reliability of whether we'll succeed from past experience. What's important is having the conviction that our technology or product is certain to be praised once it goes out into the world. Without that, we can't move even a step forward."

Making even greater contributions to quality of life

The fit and softness of AIRYFA™ are expected to make their way into masks, sanitary napkins, and other products, contributing to the improvement of QOL (quality of life). Mitsui Chemicals intends to strengthen its rollout of nonwoven fabrics into Asia, with the Chinese market holding particular promise. As China becomes increasingly stratified, luxury goods orientation is stronger than it is in Japan, with a vastly larger number of consumers seeking such goods.