



Defining “Gentle to the Skin.” What Constitutes a Thick yet Thin Diaper?

Satisfying the Senses

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From Basic Functions to Sensory Satisfaction

From 1963 onward, as disposable diapers started to gain popularity as an alternative to cloth diapers and their fulfillment of such basic requirements as producing no leaks, offering improved breathability and causing no diaper rash gradually became commonplace, demand shifted to satisfying such needs as comfort and fit. Through innovative technological development, the Mitsui Chemicals Group has successively realized highly functional and enhanced performance products that have met this demand, leading to its establishment as Asia’s No. 1 maker of high performance nonwoven for premium diapers.

In 2016, the Company received a Special Technology Prize at the Japan Chemical Industry Association (JCIA) Awards for the development of the world’s first practical nonwoven fabric that, in addition to the conventional functions, displays “gentleness to the skin” as well as “amenability of design” and that succeeded in improving “amenity.”

What is meant by “gentleness to the skin” in this context? It encompasses a level of comfort that precludes the development of rough skin, specifically, softness when in direct contact with the skin and an excellent fit that allows the diaper to follow the body’s contours and movements without compromising that softness. Translating “gentleness to the skin” into the measurable evaluation indices of smoothness, fluffiness, and flexibility, the Company utilized original resin design technologies and controlled the fiber configuration to successfully develop an innovative, high nonwoven.



Birth of Stretch Nonwovens

The pursuit of diapers with “underwear-like comfort” brought drastic changes to the market as manufacturers tried tighter-fitting designs, including the widespread use of string rubber and stretch film with poor breathability. The Mitsui Chemicals Group’s response was to begin developing stretch nonwovens in the latter half of the 1990s.

Although the process would be beset with difficulties, we took on the challenge of creating nonwovens incorporating special resins, an area other companies were not exploring, with an eye to achieving a balance between stretchability and gentleness to the skin as well as to creating distinctive products that would set us apart. To enable mass production, we repeatedly enhanced resin design, production facilities, and processes. One innovation was the introduction of technology commonly used in an unrelated industry on the recommendation of an equipment manufacturer with whom we have had a long-standing relationship. We improved on this technology, which went on to be adopted for essential processes. This flexibility that allows us to incorporate external networks and technologies from different fields is one factor that has led to our current success.

We carried out a successful trial production run in 2005. Following test sales, market release came in 2007. Adoption has been expanding in earnest since 2010. Today, we are continuing to pursue development, and are now creating nonwovens that offer improved elasticity and combine current stretchable fibers with fibers that have a positive bearing on comfort and durability.

Toward Meeting More Sensory Needs

“I would like a nonwoven fabric that is both thick and thin.” This seemingly contradictory request from a customer came as a response to a survey of consumers to determine their desires at every stage from buying diapers to disposing of them. “When making a purchase, I would like the packs to be compact, but filled with as many diapers as possible. I would however ask that each diaper have a full, thick, and soft feel when removed from the pack.” More simply put, what we arrived at was customers were concerned with the cushioning and smooth properties of diapers. Using these as indicators, we developed and repeatedly tested helically shaped, three-dimensionally controlled crimped fibers. The helical structure produces a fabric that is thick and soft at rest, but thins when pressed even lightly due to the same principles that govern springs.

The most important thing is for the diaper to be flexible when it reaches the end consumer. For that reason, feedback from dialogue with consumers is reflected in the diaper design process and collaborating with them is essential.

Flexible nonwoven fabric with unprecedented three-dimensional fluffiness through the use of helical fibers. Highly stretchable nonwovens that offers the characteristics of plastics thanks to the use of two types of fiber. Both achievements represent agglomerations of know-how that other companies cannot produce. We are proud that the Group’s high performance nonwovens, which draw on our knowledge as a resin manufacturer, have made possible a new design of diapers that are both fluffy and slim.

We want present and future customers to be satisfied with our products. With that thought in mind, in the years to come we will continue to develop further improvements in quality to meet diversifying needs.



Taking on the Challenges Presented by Lenses for Automotive Cameras

Hard Polymer Department, Polymeric Materials Laboratory, R&D Center



Specific Characteristics Demanded of Automotive Lenses

A transparent optical resin (cyclo olefin copolymer), APEL™ features high refraction and low birefringence while displaying excellent moisture-proof properties and resistance to chemicals. The product commands an overwhelming share of the market for pickup lenses for optical discs while boasting a high adoption track record for use as convex imaging lenses for mobile cameras, such as those installed in smartphones.

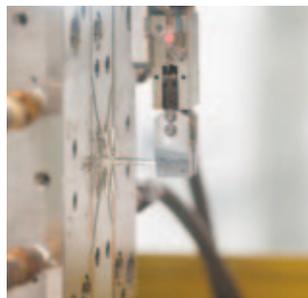
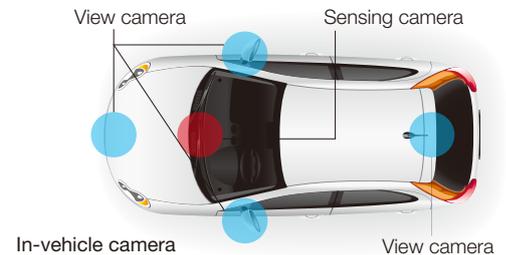
The next target market for APEL™ is that for automotive lenses, the installation of which is expected to rapidly increase. APEL™ will enter the market via view cameras—used to record and display information from inside and outside a vehicle on an in-vehicle display—and sensing cameras—used to detect, analyze and automatically control data from inside and outside a vehicle.

With autonomous driving coming ever closer to realization at an ever accelerating pace, customers are demanding performance improvements, particularly with regard to the cameras that form driving support systems. Unlike the features needed for smartphone applications, such as thinness and image quality, the top priority for lenses for automotive applications is long-term reliability. Performance requirements regarding environmental resistance, such as to heat and humidity, as well as resistance to yellowing and deformation are also remarkably high. Current glass lens performance exceeds that obtainable from plastic.

With annual production of automotive cameras forecast to more than double from the current 80 million units by 2020, it is however expected that the replacement of glass with plastic lenses will accelerate because of the freedom of design plastic enables as well as greater compatibility with mass production and cost benefits.

The Mitsui Chemicals Group began designing lenses specifically for the automotive sector in 2013. At first it proved difficult to achieve high levels of both optical performance and environmental resistance, but through repeated trial and error experiments we were able to meet customers' demanding performance requirements.

Our accumulated know-how as a resin manufacturer has been key to our success; it took us only six months to secure the capability to deliver the required performance, including heat and environmental resistance. By autumn 2014, we were able to set our sights on mass production, having chosen to adopt APEL™ as the best possible material for automotive lenses. Mass production will start in fiscal 2016, and it is expected that the APEL™ lenses will actually be installed in automobiles in fiscal 2017.



Source of Development Capabilities

Several relationships of trust were major drivers behind the success of our development efforts.

The first relationships of trust were those with customer lens makers. The creation and testing of trial products was greatly aided by these customers supplying us with actual lens molds that we could use to design and manufacture evaluation molds. When pursuing product development aimed at fulfilling customer specifications, it is best to be able to make and evaluate in-house the exact same products and techniques the customer will use. We were able to work so closely with our customers thanks to years of work building relationships of trust. We were under pressure not only because of the stringent requirements; customers had great expectations of APEL™, and our commitment to meeting those expectations strengthened our resolve.

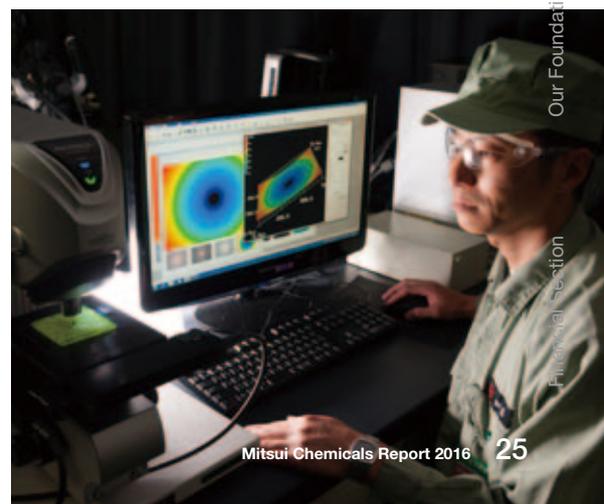
Another set of relationships of trust is internal, held together by communications between the Group's manufacturing, sales and research departments. In this regard, sales representatives take steps to quickly identify the evaluation schedules of customers and to then share this information with research and production units. Supporting such communication, we promote a unified development approach. As a result, even as it was operating at full capacity producing lenses for smartphones, the Manufacturing Department was able to complete trial products on the shortest possible schedule using the plant's existing equipment.

The development activities that began in spring 2013 are a prime example. The fact that we were able to make important decisions in a time frame of less than one year reflects the strong relationships of mutual trust and shared vision among all those within and outside the Group involved in the decision-making process.

Relationships of Trust That Will Gain in Value

A resin manufacturer's interest does not end with merely selling its product; ultimately, the manufacturer's success rests on the resin it has sold performing to specifications, in this case as part of the automotive camera or sensor that is the end product. It is essential that the manufacturer be able to ensure the ongoing stable production of lenses with the precision that customers demand. For that reason, we constantly strive to further improve our products' physical properties in terms of compatibility with the processing equipment and ease of production. Also, to circumvent delays due to manufacturing hiccups, we are always working on improvements with production equipment manufacturers.

Ultimately, we want to produce lenses with the specific optical characteristic of never blurring, no matter how intense the heat and humidity. The Group will fine tune APEL™ as a lens material with an established presence and accelerate improvements in performance of automotive cameras and sensors.



Our Vision

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Financial Section