"Creating Lenses that Protect Eyes and Make Lives More Comfortable"

Director of Optical Function Design Department,
Synthetic Chemicals Laboratory, Mitsui Chemicals, Inc.

Mamoru Tanaka

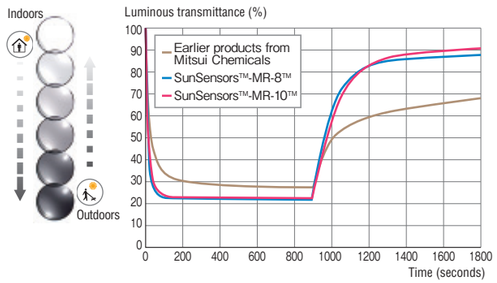
Lenses × Pigment

Mitsui Chemicals, Inc. boasts a 90% global share in high-refractive index ophthalmic plastic lens materials. The company has steadily expanded its business, crossing swords with competitors on the world stage for 30 years. The wellspring of that energy is the "spirit of manufacturing" handed down for over a hundred years at the company's Omuta Works in Fukuoka Prefecture in Japan. It is found in Mamoru Tanaka, who leads ophthalmic lens materials development.

The city of Omuta retains the remains of the Miike Coal Mine that gave support to Japan's modernization. In the central part of the city is Mitsui Chemicals' Omuta Works, which began in 1912 as a production plant for chemicals using the by-products of coke manufacturing. Even now, the grounds of the works contain massive brick buildings that recall the era, and tracks of the trains that transported coal.

Sited on one corner of the grounds is the research facility for ophthalmic lens materials. In the bright interior of the facility, which opened just two years ago, equipment for mixing compositions and pouring them into lens molds, heating equipment for solidifying resins, and other new manufacturing and evaluation equipment unique to lens manufacturers is running. Ophthalmic lens materials are the leading products of Omuta Works. Drawing on thiourethane-based materials that make use of synthetic organic chemical technology originating in coal chemicals, Mitsui Chemicals has conquered the world market with its high-refractive index ophthalmic plastic lens materials, and currently has a share of 90%.

"In the research facility, we're pursuing lens manufacturing process conditions that are optimal for new lens materials. Our aim is to provide these materials and process conditions to the world's lens manufacturers, who will actively use them in new products," says Mamoru Tanaka, who leads lens materials development.



As shown in the above graph of luminous transmittance, SunSensors™ of photochromic lens materials develop color much faster than earlier products when struck by ultraviolet rays, and quickly regain transparency when not.

Developing beyond 30 years in the lens business

In the latter half of the 1980s, manufacturers of ophthalmic lens materials competed to develop high refractive index resins to enable thin, light lenses. In 1987, Mitsui Chemicals made its name known worldwide with the successful development MR-6™, a monomer for lenses with a high-refractive index of 1.60. Tanaka joined the company in 1994, at the height of the development competition.

"Other companies had launched new products with a refractive index of 1.70. In response, we decided to productize a 1.70 monomer with our thiourethane materials. I was of course involved with monomer design and development, but also design of the manufacturing process and even construction of the plant," says Tanaka. In 2000, the company launched MR-174™, which boasted a refractive index of 1.74, the highest in the world at the time.

"We had increased the amount of sulfur additive to boost the refractive index, and struggled to deal with the odor coming from the manufacturing process. We were able to overcome this through teamwork with process engineers," recalls Tanaka of that time.

The ongoing challenge of protecting eye health

The direction for ophthalmic lens materials development has shifted markedly to protecting people's eyes, or vision care. This year, the company became the first in the world to develop in-mass photochromic lens materials with refractive indexes of 1.60 and 1.67, the SunSensors™-MR-8™ and MR-10™.

Photochromic lenses change from clear to black or brown when struck by ultraviolet rays, or are used in eyeglasses that combine the functions of sunglasses outdoors and normal clear eyeglasses indoors.

They develop color by absorbing the ultraviolet rays that are said to be harmful to eyes outdoors, and reduce brightness. The key factor in this is a photochromic pigment that develops color by changing shape when struck by ultraviolet rays.

In 2014, Mitsui Chemicals acquired the brand and technology for middle-refractive index photochromic lens materials based on acrylic material from U.S.-based Corning Inc. Building on this, the company undertook development of photochromic lens materials based on thiourethane materials, which surpasses acrylic resin in refractive index and in strength.

"Photochromic pigment didn't develop color in our company's thiourethane resin. We conducted repeated research, discovered proprietary technology for creating spaces in which color development would work even within the mesh structure of the resin, and succeeded in making color development happen," says Tanaka with pride.

In addition to this product, the company offers lens materials that include UV+420cut™, an ophthalmic lens material that helps protect eyes from not only ultraviolet rays (400nm and shorter) but also 400nm-420nm wavelength light, and NeoContrast™, which provides pinpoint control of wavelengths in the area of 585nm, which is said to have a strong effect on brightness and perception of color.

"We plan to further develop the assets that our forerunners worked hard to build in the past, and undertake development of lens materials that protect eyes," adds Tanaka. Over a century has passed since the founding of the Omuta Works. Even as the shape of the industry changes, the spirit of manufacturing continues to be handed down.

Creating breakthrough lens materials that protect eyes

Mitsui Chemicals is going beyond existing ophthalmic lens technology, leveraging the chemical products, films, nanotechnology lineup, and basic research capabilities it possesses as a diversified chemical company. Doing so, the company aims to create innovative lens materials that meet customers' needs and resolve ophthalmic issues, in areas of both ocular health and comfort.