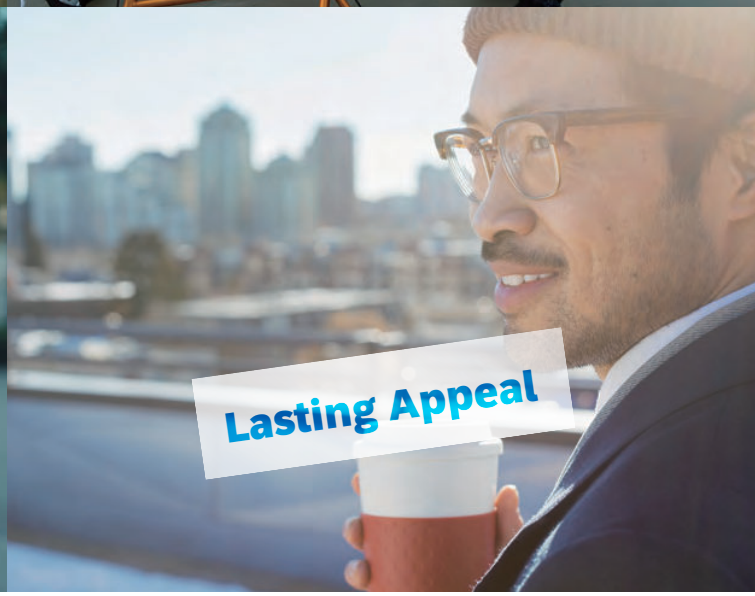
MR™

High Refractive Index Lens Material

Product Handbook



About Mitsui Chemicals

Mitsui Chemicals

Since its founding in Japan in 1912, Mitsui Chemicals has supplied innovative products in various fields, from health care-related materials to automotive, electronics, information, life, environment, and energy materials. We have over 30 years of experience developing optical lens technology and offer a range of high-quality eyeglass lens materials and vision care solutions. Our products are used by lens manufacturers worldwide and are designed to improve vision and comfort. Our goal is to provide people with a clearer view of the world through our "Quality of View (QoV)" concept.

Mitsui Chemicals Inc.
Tokyo Midtown Yaesu Yaesu Central Tower
Tokyo, Japan

R&D Capabilities

Mitsui Chemicals is a leading chemical company that supplies urethane products worldwide. In 1987, we developed MR-6™, the first optical lens material using thiourethane chemical technology. This innovative product was created with the support of our high-standard global research and development network.

VISION HUB™ SODEGAURA
Chiba, Tokyo

History of Mitsui Chemicals' Vision Care Materials

Pioneer in the high index lens material development

Early 1980s	Started development of high index lens materials
1987	Launch of MR-6™, the world's first thiourethane high index ophthalmic lens material (R.1.1.60)
1991	Launch of MR-7™, the world's first refractive index 1.67 ophthalmic lens material
1998	Launch of MR-10™ (R.1.1.67)
1999	Launch of MR-8™ (R.1.1.60)
2000	Launch of MR-174™ (R.I. 1.74, Do Green™ : plant-derived materials)
2008	Acquisition of SDC Technologies, Inc. (USA), a California-based premium coating material company
2009	SDC Technologies acquired Film Specialties, Inc. (USA), an anti-fogging coating specialty company
2011	Acquired Acomon Group (Switzerland & Italy), one of the world's leading companies in low R.I. lens materials
2013	Acquired KOC Solution Group (currently ML Tech), a medium R.I. lens material company (Korea & China), as a group company
2014	Acquired photochromic materials from Corning Inc. (USA)
2015	SDC Technologies acquired LTI Coating Technologies (USA), a manufacturer of UV-curing hard coating materials
2020	SDC Technologies acquired COTEC® (Germany), a hydrophobic & anti-reflective coating material company
2021	Acquired 100% ownership of KOC Solution Group (currently ML Tech Co., Ltd.) (Korea & China)
2022	Launch of of MR-160DG™ (R.I. 1.60, Do Green™: plant-derived materials)
2022	SDC Technologies acquired Coburn Technologies (USA), an eyeglass lens processing equipment company

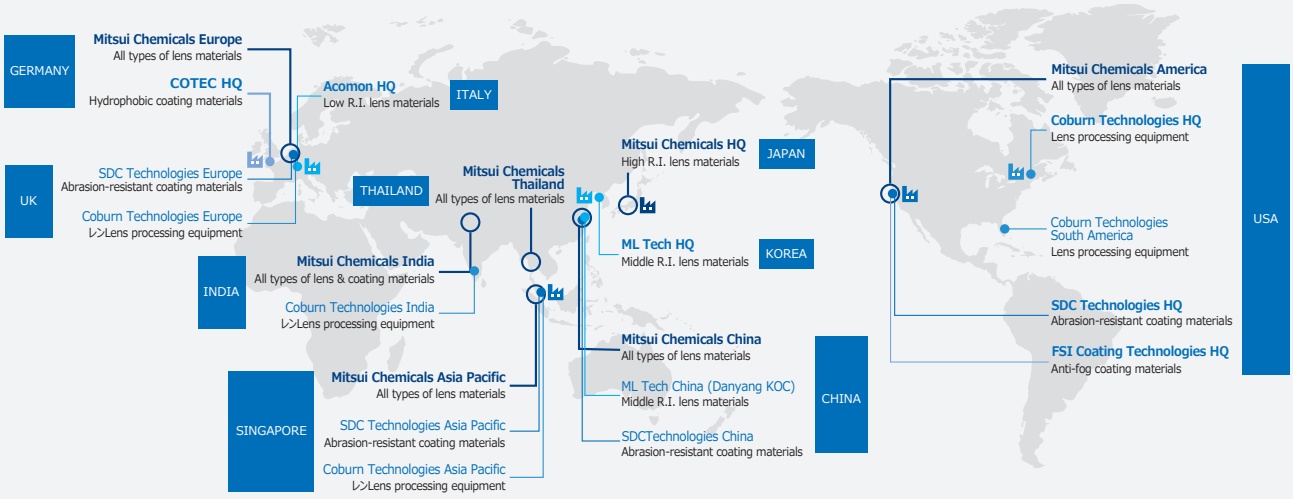
Production, Quality Control and Environmental Responsibility

High-end Chemical Plants

MR™ is produced and delivered according to strictly-controlled operation protocols to ensure the sustainable supply of high-quality materials to lens manufacturers.
The MR™ production plant is certified under ISO 9001, and strict precautions are taken not only in monomer production, but also in packaging, storage, and logistics. All conceivable measures are taken to prevent accidents.
As a chemicals company that has obtained OHSAS 18001 certification, workplace environment and safety are top priorities. Additionally, being certified under ISO 14001, all operations at the MR™ plant are conducted with careful consideration to minimize environmental impact.

Global Network

The sales, marketing, and technical services for MR™ and RAV 7™ are managed by the Mitsui Chemicals global headquarters in Japan and seven regional headquarters around the world.
This setup enables rapid customer service in multiple languages for the highest customer satisfaction.
Additionally, with companies specializing in medium to low R.I. eyeglass lens materials and coating materials joining under our umbrella, the synergy effect is realized, allowing us to continue providing optimal quality of view (QoV) for eyeglass wearers.



MR™ Product Lineup

MR™ is the de facto standard brand for safe, clear, lightweight, and high R.I. lens materials.

MR™ high-index lens materials achieve a high refractive index and high Abbe value while lightweight and impact resistant through unique monomer polymerization. It was developed as the first thiourethane-based high refractive index lens material to be used in the field of eyeglass lenses. With its diverse product lineup, MR™ provides eyeglass lens users with the best solutions.

R.I. 1.60

MR-8™ MR-160DG™

MR-8™ has a high Abbe value which means minimal chromatic aberration in the visual periphery while maintaining an ideal balance of properties such as impact and thermal resistance. Under the Do Green™ series, MR-160DG™ is made from plant derived lens materials. They are recommended for a wide range of designs and purposes, and optical powers ranging from nearsightedness to presbyopia.

R.I. 1.67

MR-7™ MR-10™

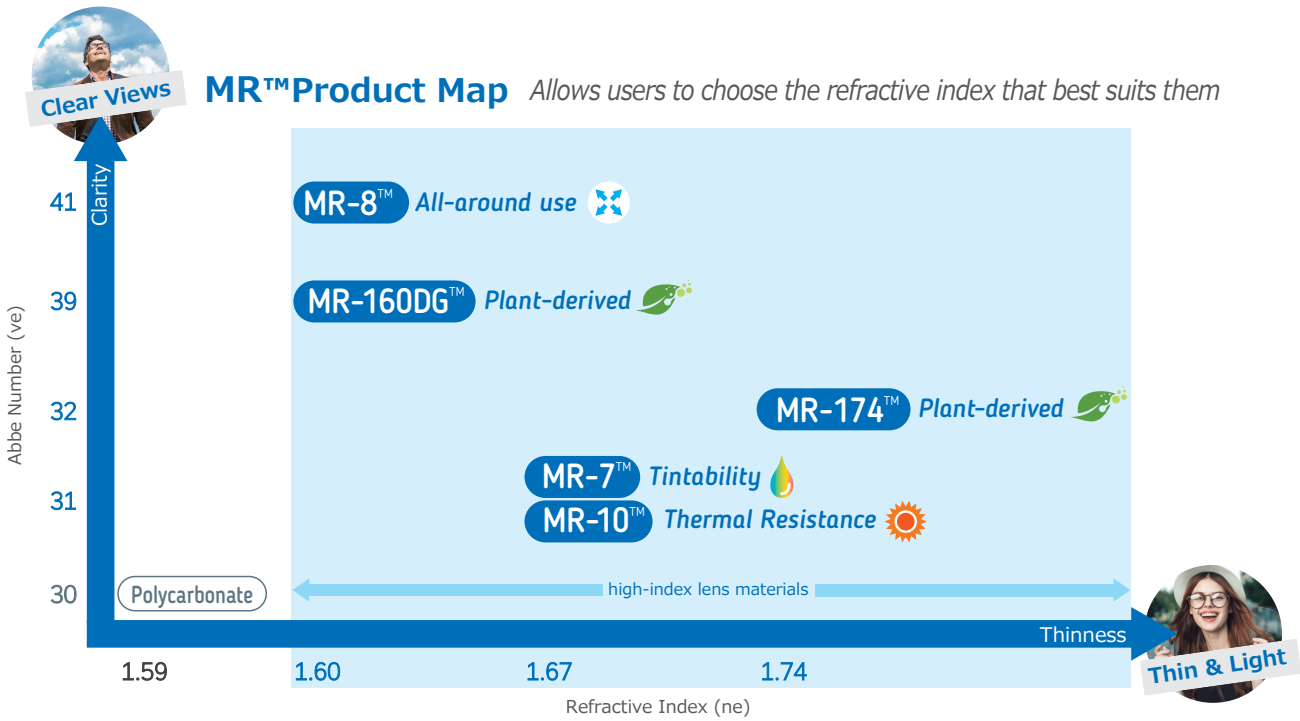
Featuring a balance of lens thinness, lightness, and high impact resistance, MR-7™ offers good tintability while MR-10™ offers superb thermal resistance. They are recommended for users with higher prescriptions for a more comfortable wearing experience. The MR-7™ with its good tintability is ideal for sunglasses and fashion-oriented glasses. The heat-resistant MR-10™ lens offers added safety for use under challenging temperature conditions.

R.I. 1.74

MR-174™

MR-174™ makes it possible to produce ultra-thin lenses of the highest refractive index. As a Do Green™ product, it is made using plant-derived materials.
They are recommended for users looking for the ultimate in thinness and those who are especially eco-conscious or prefer the highest possible quality.

MR™Product Map *Allows users to choose the refractive index that best suits them*



Comparison of physical properties: MR™ lens materials versus other optical materials

	MR™				Other Materials				
	MR-8™	MR-7™	MR-10™	MR-174™	Polycar-bonate	Acryl	Middle Index	Low Index	Crown Glass
Refractive Index (ne)	1.60	1.67	1.67	1.74	1.59	1.60	1.55	1.50	1.52
Abbe Number (ve)	41	31	31	32	28 - 30	32	34 - 36	58	59
Heat Distortion Temperature (°C)	118	85	100	78	142-148	88 - 89	–	84	> 450
Tintability	Good	Excellent	Good	OK	None	Good	Good	Good	None
Impact Resistance	Good	Good	Good	OK	Good	OK	OK	OK	Poor
Static Load Resistance	Good	Good	Good	OK	Good	Poor	Poor	Good	Good

All properties are representative measurement figures obtained under specified test methods at Mitsui Chemicals, Inc. and are not guaranteed as specifications.

The quality of MR™ is protected by patents.

MR™ technology is constantly being improved to ensure customer satisfaction. As a result, we have been granted numerous patents in countries globally, and we are continuously filing patent applications. We will continue to apply for and obtain patents in line with technological innovations, which will help us to continue providing high-quality MR™-related products that meet our customers' expectations.

For an updated list of important patents and patent applications related to MR™ in the field of vision care, please scan the QR code or click HERE.

We protect and strengthen our MR™-related brands.

We have acquired the rights to several MR™-related trademarks globally, and we are committed to safeguarding and enhancing our MR™ brand. These trademarks serve as proof that our MR™ products are ours to customers who purchase our monomers and eyeglass lenses made from those monomers.

Durable

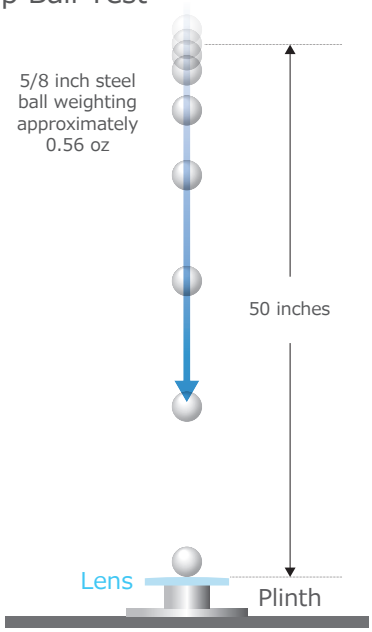
Not only is it strong against impact, but MR™ also offers high toughness. When force is applied, MR™ lenses deform instead of breaking which prevents cracks and chipping.

The tough thiourethane resin makes it possible to create eyeglass lenses that are thin but resistant to impact. Even rimless and drill-mount designs are less likely to crack or chip, rest assured. Additionally, this resin is easy to work with and can be processed into various designs when making eyeglasses.

High Impact Resistance

High impact resistance ensures the safety of eyeglass wearers.

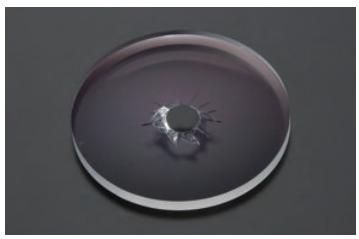
■ FDA Drop Ball Test



MR-8™ lens

No Damage

Acrylic lens



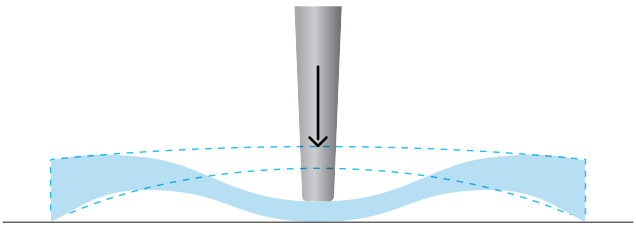
Damaged

US FDA (Food and Drug Administration) Sec. 801. 420
"Use of impact-resistant lenses in eyeglasses and sunglasses"

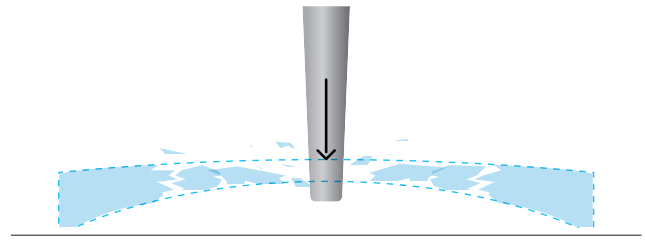
High Static Load Resistance

When measuring resistance to cracking, it's important to consider toughness, not just strength of the object. Toughness refers to the "resistance to destruction" caused by impact or pressure, and can also be described as the tenacity of a material. Thiourethane-based MR™ is strong against impact and exhibits high toughness. It deforms without breaking under force, reducing cracking and chipping.

MR™ lens



Middle-index lens / Acrylic lens



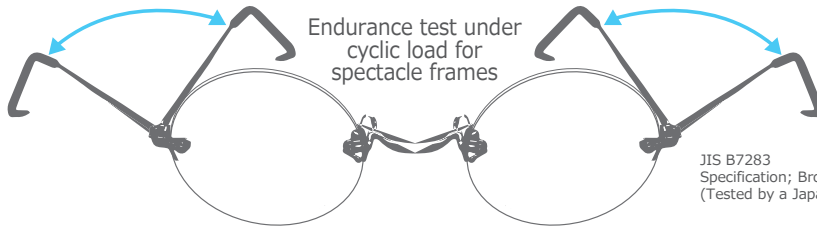
High Lens Processibility

The material is resistant to cracking and chipping, making it easy to process and suitable for any type of frame, including rimless, semi-rimless (half-rim), and high-curve lenses (sports).

■ Butterfly Test for Rimless Frame

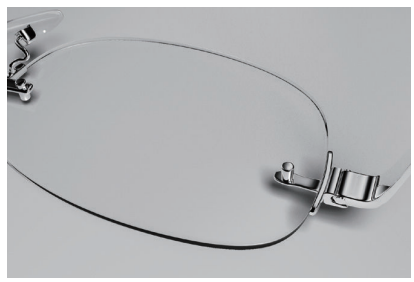
Bending Test

Endurance test under cyclic load for spectacle frames



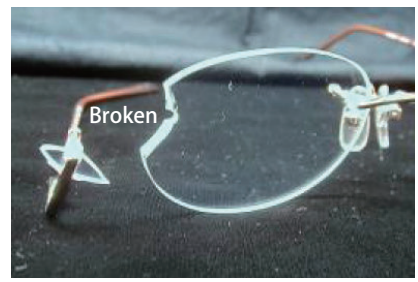
JIS B7283
Specification; Broke at 20,000 strokes
(Tested by a Japanese lens manufacturer)

MR-8™ lens



30,000 times without damage

Acrylic lens



Broken after 18,100 times

Test Video

Thiourethane-based MR™ lenses and acrylic lenses look nearly identical; you wouldn't be able to tell them apart. However, the two lenses are made from completely different materials, and their physical properties differ greatly. We dropped a metal ball onto the lenses, stepped on them with a chair and high heels, and used everyday tools to confirm the true strengths of MR™ lenses.
Watch the videos by scanning the QR code or click HERE.

Tests were conducted at Mitsui Chemicals, Inc. and are not guaranteed as specifications.

Clear Views

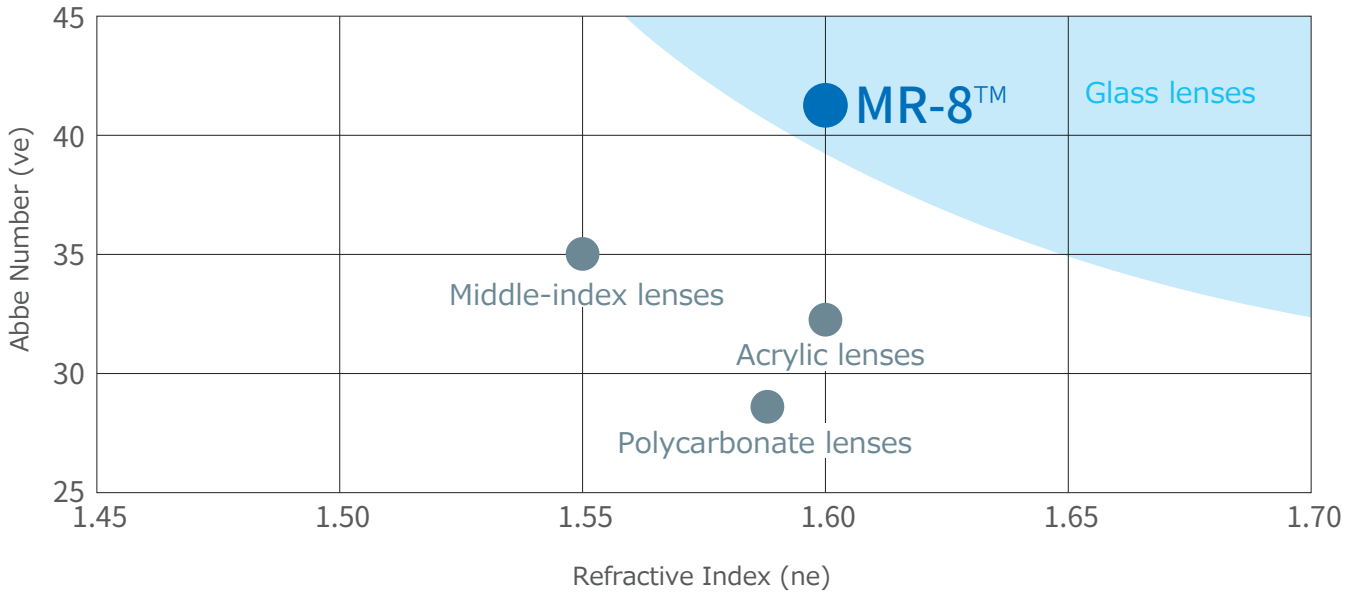
MR™ achieves a high level of optical clarity (Abbe value), which is typically difficult to attain with a high refractive index, and provides clear vision.

As the lens power increases, the light passing through the lens is dispersed by the prism effect (chromatic aberration), which can cause color fringing in the field of vision. Lens materials with a high Abbe value, such as MR-8™, can reduce color fringing.
In addition, MR™ is polymerized uniformly within the glass mold, providing clear vision without distortion.

*The Abbe number indicates the degree of light dispersion/chromatic aberration..

High R.I. with High Abbe Value

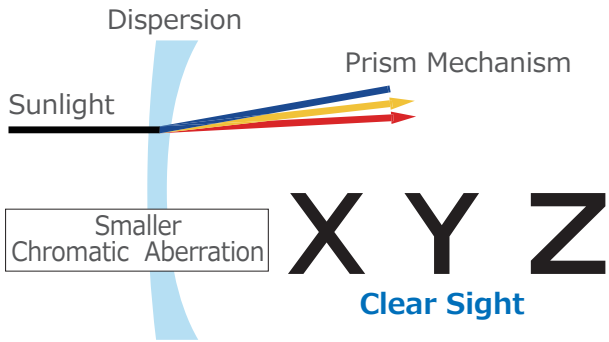
A high refractive index and Abbe number provide optical properties comparable to those of glass lenses. Generally, the higher the refractive index of a plastic lens material, the lower its Abbe value tends to be. Choosing a high refractive index lens to reduce thickness can lead to color fringing. However, with MR-8™, the lens thickness is reduced while minimizing color fringes and maintaining a high refractive index and high Abbe value.



Reduced Chromatic Aberration

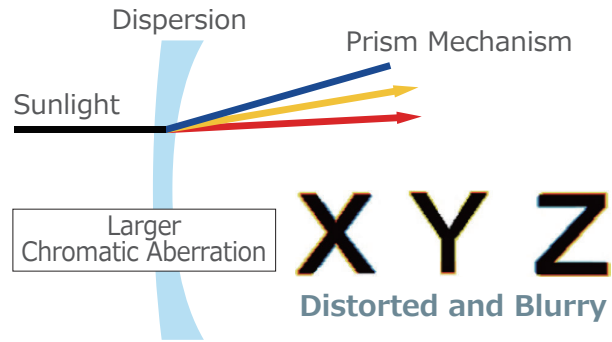
The Abbe value can determine the visual comfort of glasses. Materials with a high Abbe value, like MR-8™, minimize color fringing and enhance comfort for the lens wearer. When light passes through a lens (prism), it's dispersed into constituent spectral colors due to varying refractive indices. This phenomenon can cause what looks like color fringes and is known as chromatic aberration. This is seen as red and blue in the field of view through the lens. It is particularly noticeable in the periphery of the lens, where the dispersion is greater depending on the angle of incidence of the light. The higher the Abbe number, the lower the dispersion, therefore reducing chromatic aberration and enhancing visual quality.

High Abbe Number — MR-8™ lens : 41



Clear Sight

Low Abbe Number — Polycarbonate lens : 27-30, 1.60 Acrylic lens : 32, Middle-index lens : 34-36



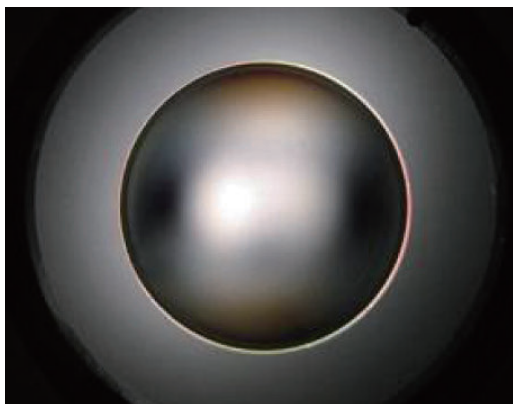
Distorted and Blurry

Minimal Len Distortion

MR™ polymerizes uniformly inside the glass mold. By slowly solidifying over time, it is possible to mold lenses without distortion. Compared to injection-molded polycarbonate lenses, MR™ lenses demonstrate minimal stress-strain, providing clear, stress-free vision.

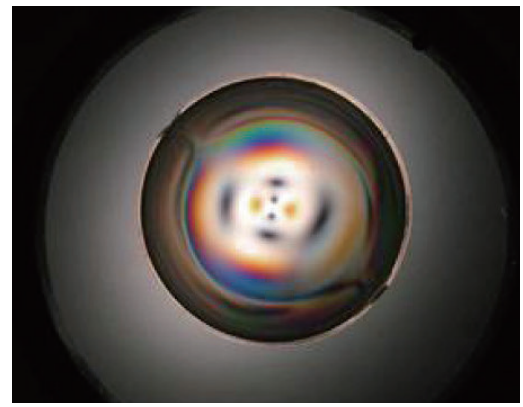
■ Stress Strain Observation (Crossed Nicol Method using polarizing film and white light source)

MR-8™ lens



No stress-strain

Polycarbonate lens



Severe stress-strain

MR-8™ offers clear, stress-free vision.

Tests were conducted at Mitsui Chemicals, Inc. and are not guaranteed as specifications.

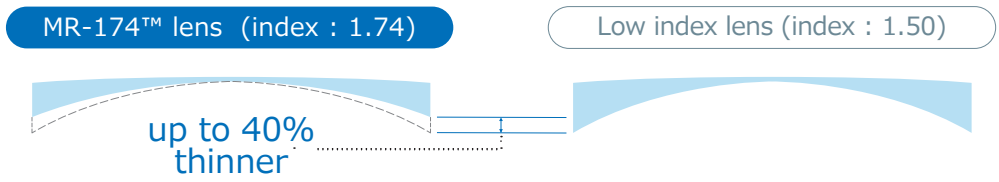
Thin & Light

The highest refractive index of MR™ allows for thin lenses even with strong prescriptions. The slim look and light feel make for an active everyday life.

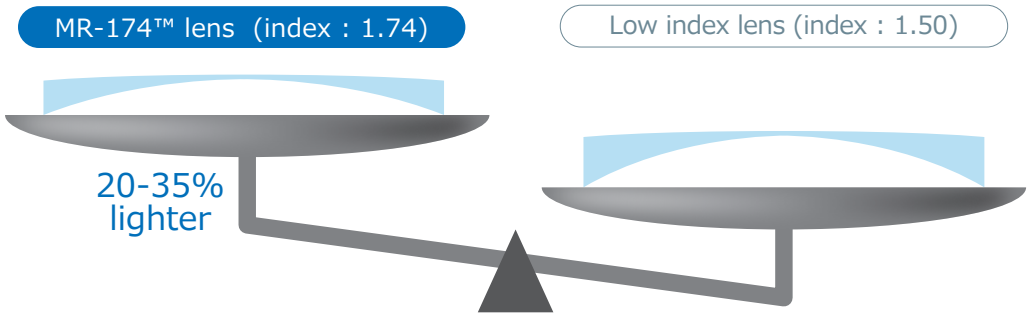
The higher the prescription, the thicker and heavier the lenses tend to be. However, the development of high refractive index lens materials has made it possible to create thinner and lighter eyeglass lenses. With MR™, it is comfortable to wear glasses without noticing the lens thickness, even with high prescriptions.

High Refractive Index

By increasing the refractive index of the lens, the lenses can be thinner with the same prescription. MR-174™ with a high refractive index of 1.74 can be up to 40% thinner than a low refractive index lens (1.50).



When comparing the weight of lenses, MR™ lenses are approximately 20-35% lighter than other products. Being that MR™ lenses are lighter in weight, they are less likely to slip out of place and are less likely to leave marks on your nose.



Lasting Appeal

MR™ achieves high adhesion to various surface coatings and is resistant to UV rays and heat, significantly extending the lifespan of eyeglass lenses.

MR™ has excellent weather resistance and discoloration of the lenses over time is hardly seen. Moreover, because it adheres well to surface coating materials, wearers are less likely to experience peeling, even with long-term use.

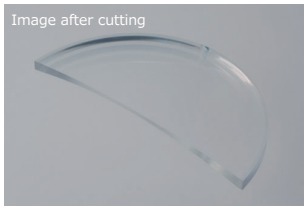
High Weather Resistance

■ Weather Resistance Test

MR™ is UV resistant, so it will not yellow over time.

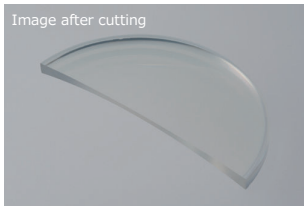
In testing of long-term use, MR-8™ only showed a slight color change, even after exposure to strong UV rays. Lens wearers can enjoy clear vision even after long-term use.

MR-8™ lens



No yellowing even after long-term use

Acrylic lens



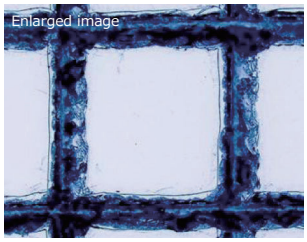
Yellowing after prolonged use

■ Coating Peeling Test

MR™ achieves high adhesion with coatings, therefore the coatings are less likely to peel off even after long-term use.

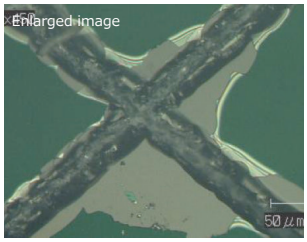
MR-8™ is highly compatible with coating materials. Lens wearers can enjoy consistent coating performance even after long-term use.

MR-8™ lens



No peeling of coating

Acrylic lens



Peeling of coating

Tests were conducted at Mitsui Chemicals, Inc. and are not guaranteed as specifications.

Learn more about MR™.
Scan the QR code or click HERE.

Mitsui Chemicals

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