Optical Materials Business Briefing

MITSUBISHI GAS CHEMICAL COMPANY, INC.

Optical Materials Division,
Specialty Chemicals Business Sector

July 3, 2023

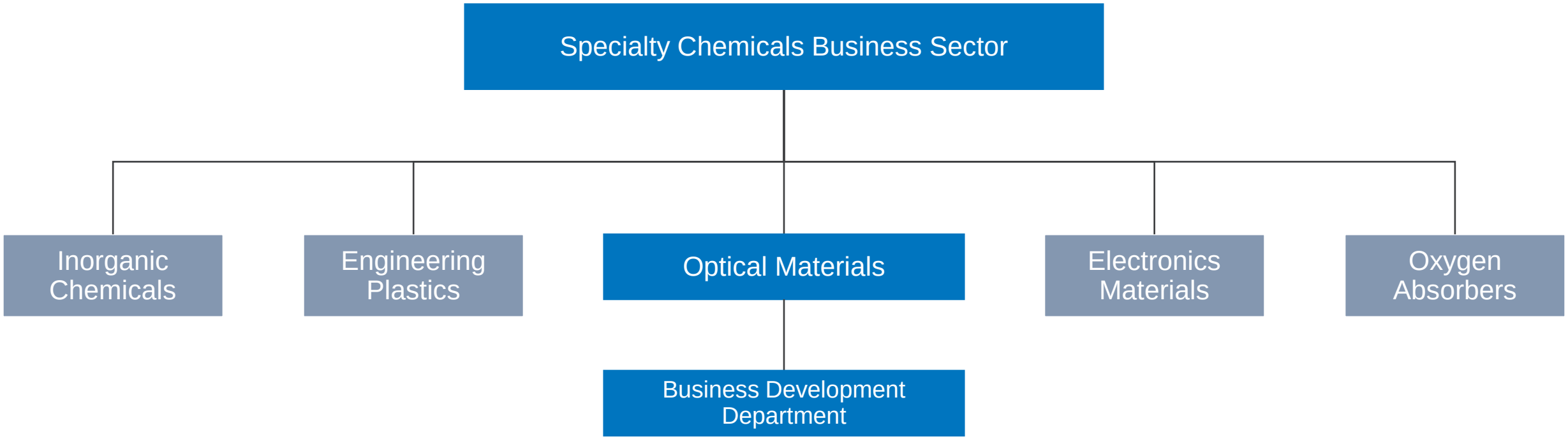
Securities Code
4182

Index

1. Optical Materials Business

Optical Materials Division Organizational Chart

– In April 2019, we established the Optical Materials Division to handle optical products formerly under several different divisions.



Main Products of the Optical Materials Division

Products Featured Today

Optical resin/polymer

Iupizeta™ EP

- Smartphone camera lenses
- In-vehicle camera lenses
- Security camera lenses

Lens monomer

IURESIN™

- Plastic ophthalmic lenses

Optical resin/polymer

Optimas™

- Light guide plate
- VR lenses

Solvent-soluble special PC

Iupizeta™

- OPC binders
- Solvent casting process

Optical-curing resin composite

LumipluS™

- Nano imprint
- Optical adhesives

Main Sites of the Optical Materials Division

Niigata Plant, Kita-ku, Niigata City

Optimas™ plant

Iupizeta™ EP raw-material plant
(scheduled for completion in 2023)

Naniwa Plant, Taisho-ku, Osaka City

Lens monomer plant

Optical Materials Division

Main Roles

- **Strategizing**
- **Sales and marketing**
- **Development assistance**
- **SCM**

Tokyo Research Laboratory

Main Roles

- **Development of optical polymers**
- **Development of lens monomers**

Kashima Plant, Kamisu City, Ibaraki Prefecture

Iupizeta™ EP polymerization plant
(phases completed in 2016, 2019 and 2022)

2. Optical Resin/Polymer

(1) Iupizeta™ EP

Optical Resin/Polymer: Iupizeta™ EP

– Special polycarbonate with **high refractive index, low birefringence, high transparency, high heat-resistance, and good moldability**

Environmental **P**rotection

Zero emissions / Recycling waste from customers

Environmental **P**rocess

Low-environmental-impact production processes / Zero solvents, low waste

Environmental **P**lastics

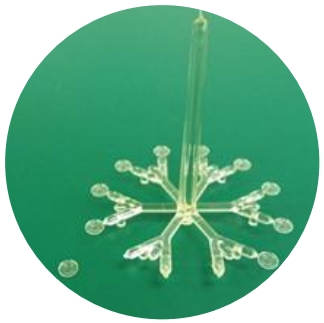
Higher injection-molding production efficiency / Material design with production efficiency in mind

Iupizeta™ EP Business Domains

Business domains

Monomer

Polymer



Injection molding

Modularization

Smartphone lenses

Raw-material suppliers

In-house production of some monomers is planned

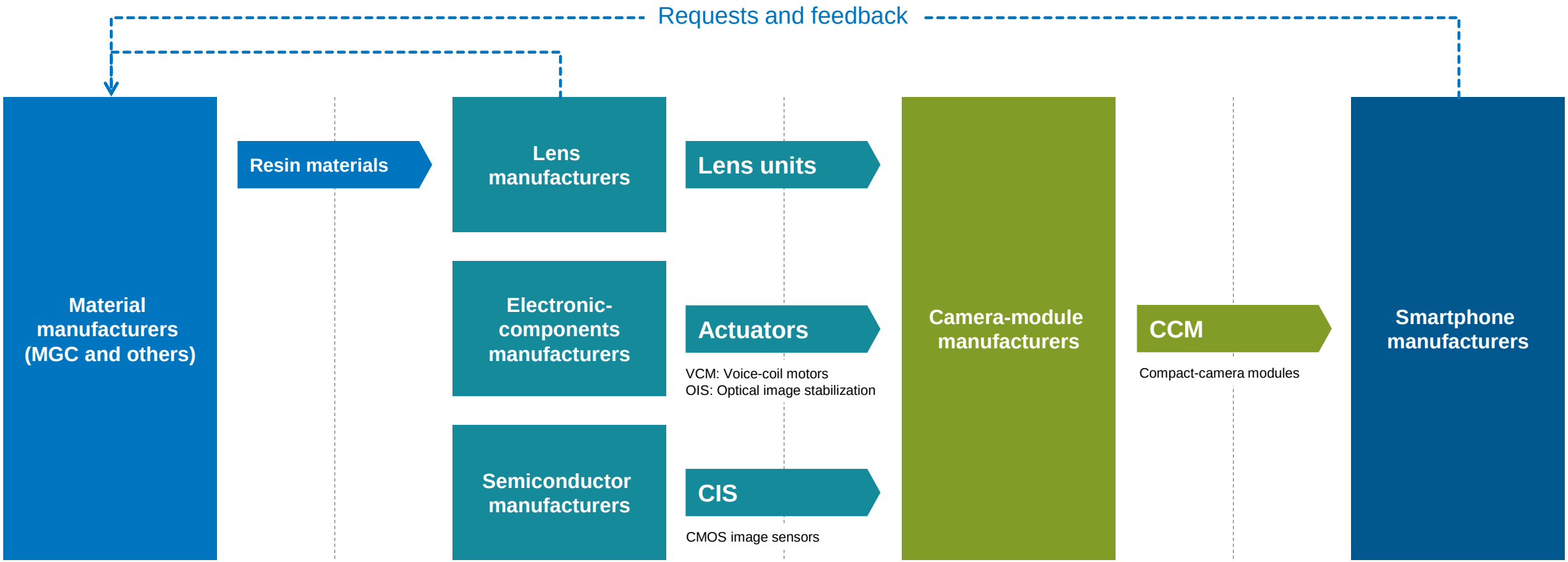
Lens manufacturers

Camera-module manufacturers

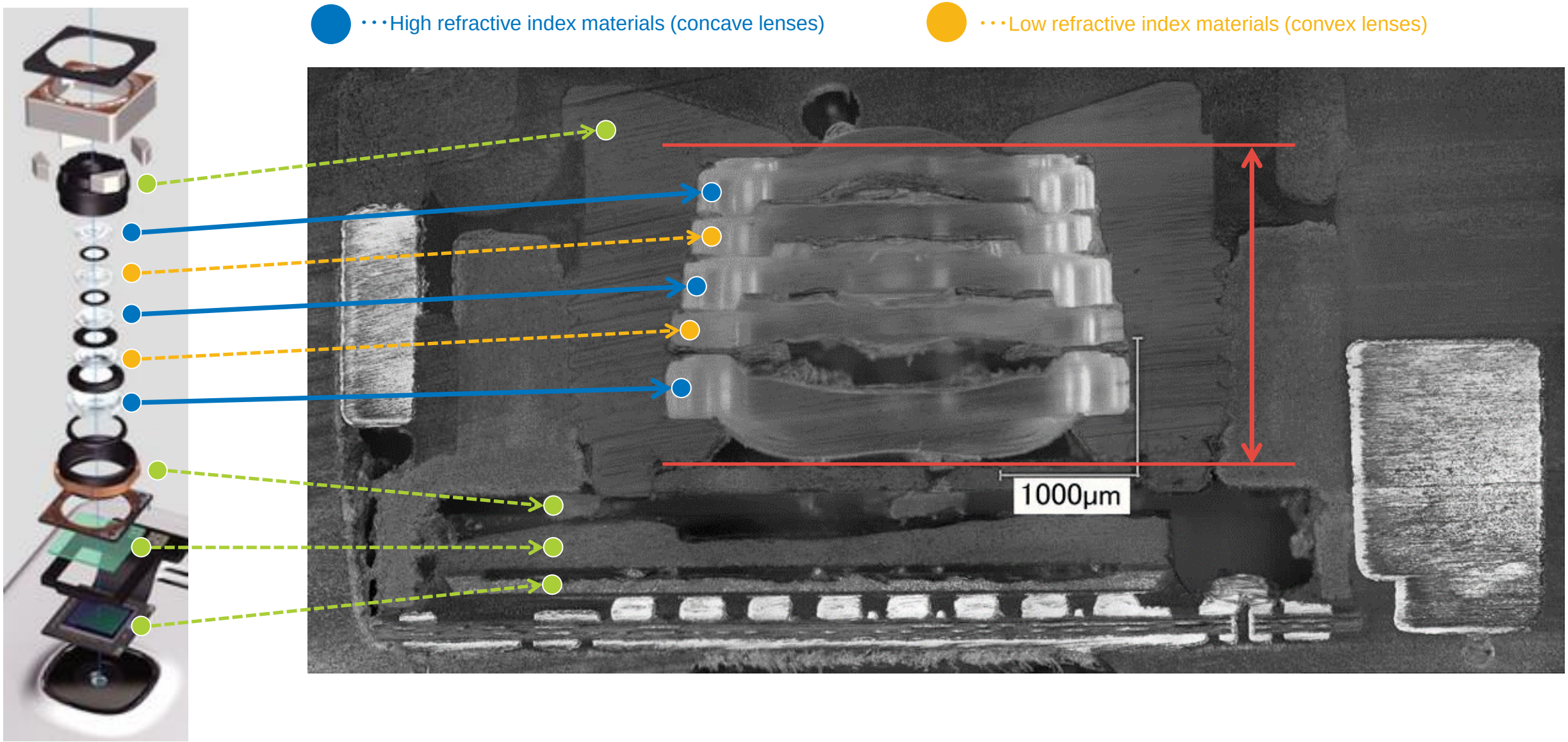
Smartphone manufacturers

Iupizeta™ EP Supply Chain

– In selecting and evaluating camera-lens materials, we actively approach smartphone manufacturers, who often make requests and provide feedback



Structure of Small Camera for Smartphone

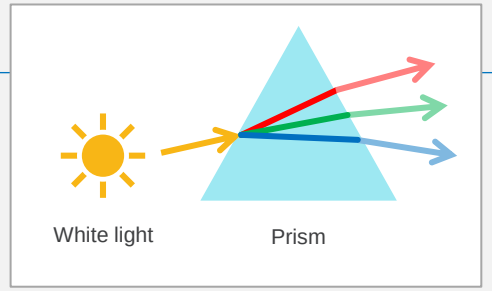


Roles of Convex and Concave Lenses

Characteristics of light (1)

When bent, light divides into color strips

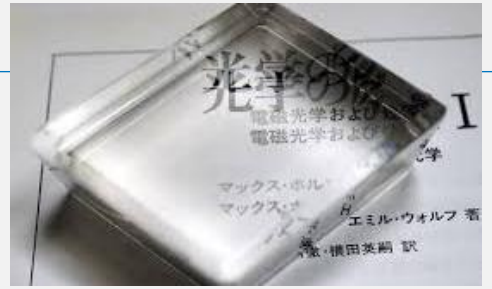
(Refractive index depends on wavelength)



Characteristics of light (2)

Light divides when passing through an object

(Double refraction)



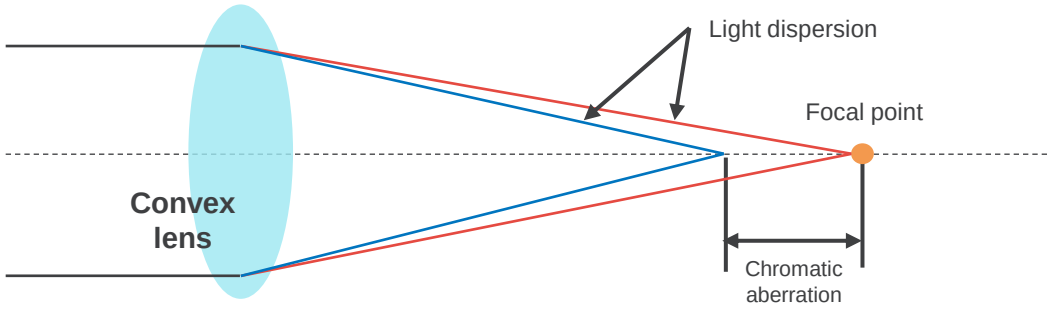
Abbe's number

Indicator of light dispersion

- **Material with high Abbe's number** = converges light = **convex lens**
- **Material with low Abbe's number** = corrects deviation of focal point caused by light dispersion = **concave lens**

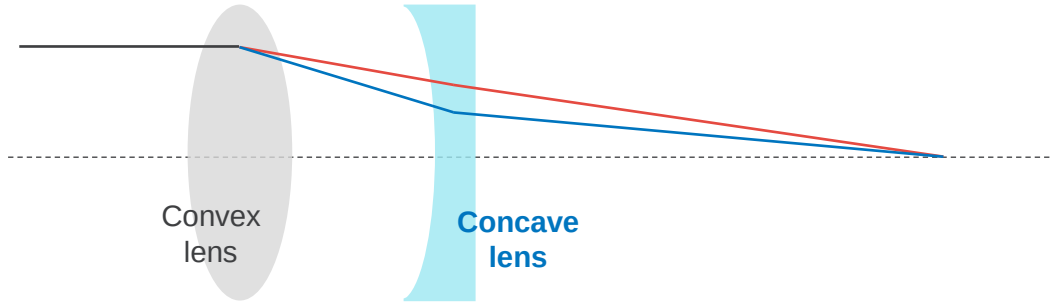
Convex lens (high Abbe's number)

Function: Converges light
Materials: Cycloolefin copolymer (COC) and cycloolefin polymer (COP)
Feature: Smaller refractive divergence between red and blue light



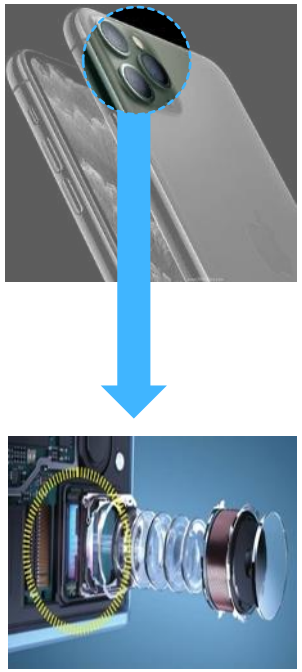
Concave lens (low Abbe's number)

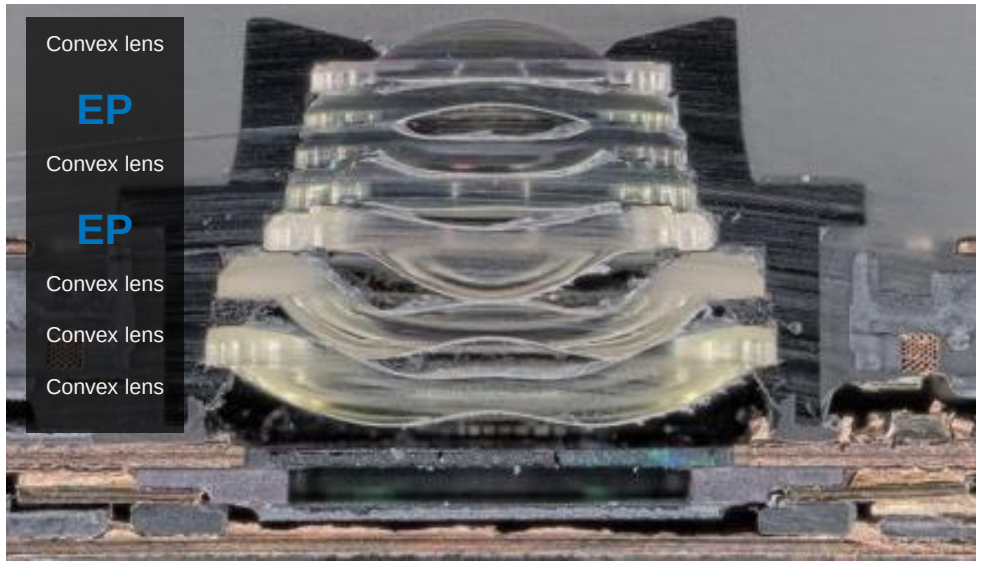
Function: Corrects deviation of lens focal point
Materials: **Iupizeta™ EP** and similar
Feature: Very strong effect in bending blue vs. red light



Background of Iupizeta™ EP Application for Smartphone Camera Lenses

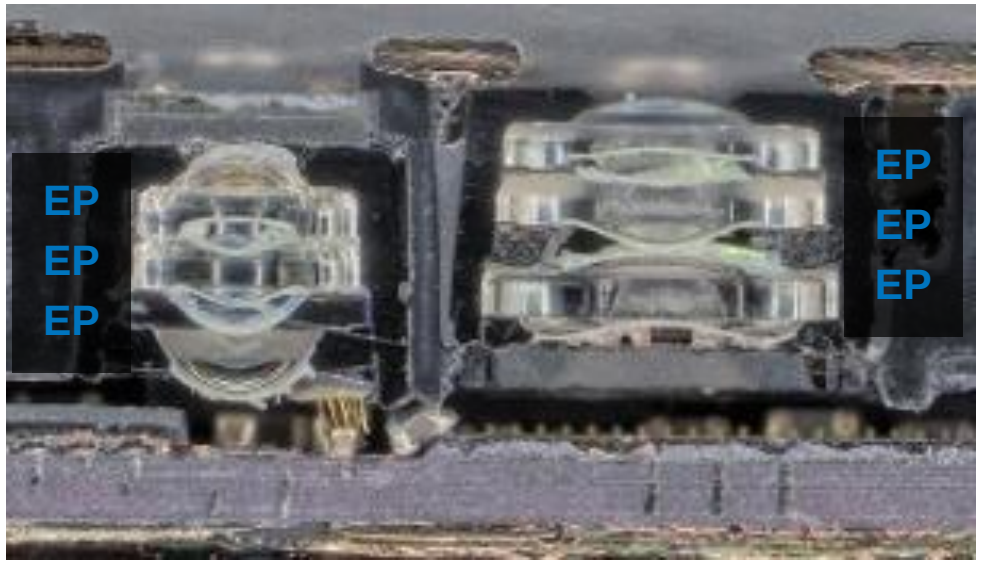
- A small camera lens is generally made of **convex lenses** that converge light **(low refractive index materials like COP and COC)** and **concave lenses** that correct optical aberration **(high refractive index materials like Iupizeta™ EP)**
- **Because stacking lenses adds to thickness, opportunities to use Iupizeta™ EP, with its high refractive index for thinner cameras, are growing**





A camera needing color correction

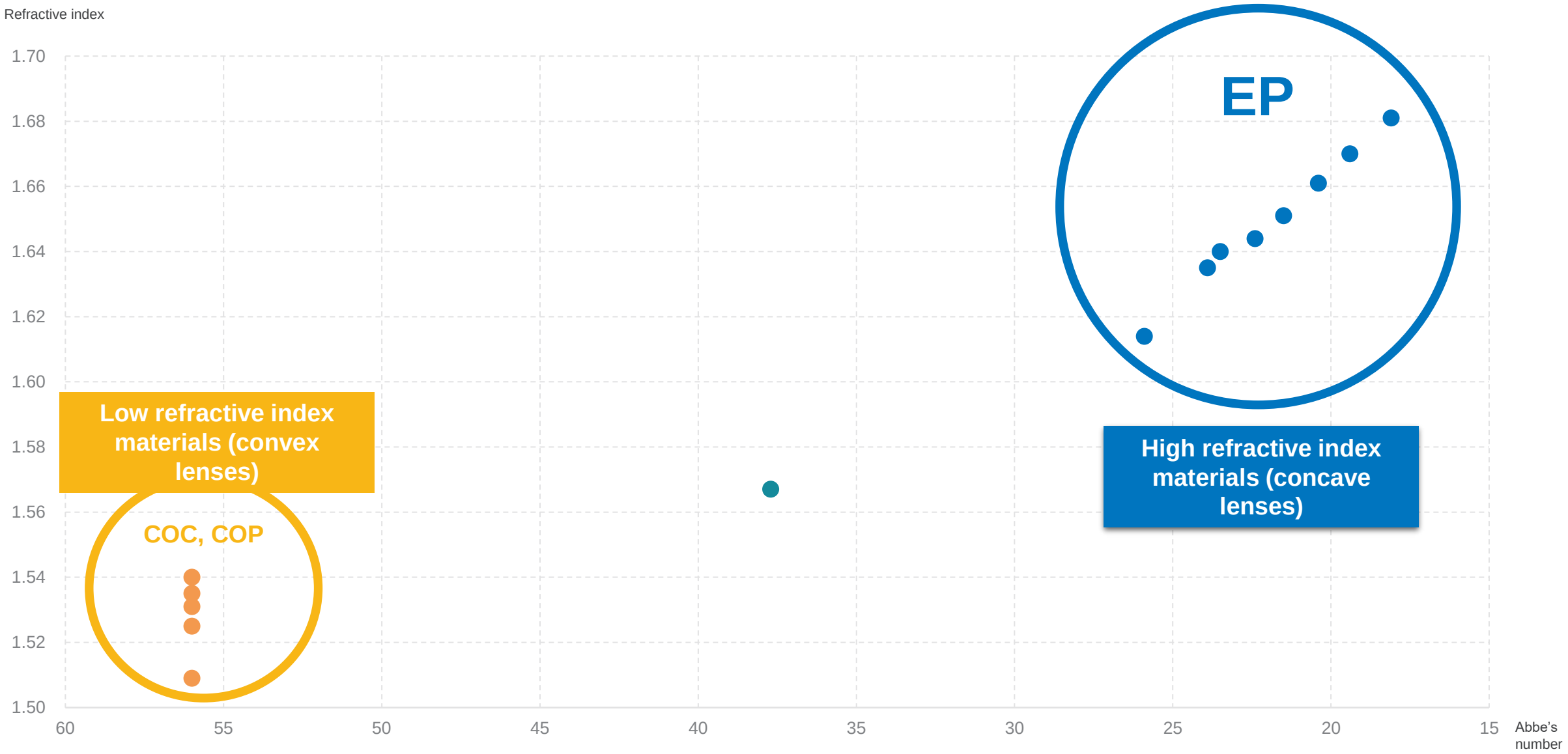
Rear main camera of a high-end smartphone



A camera needing no color correction and designed to be thinner

LiDAR scanner of a high-end smartphone

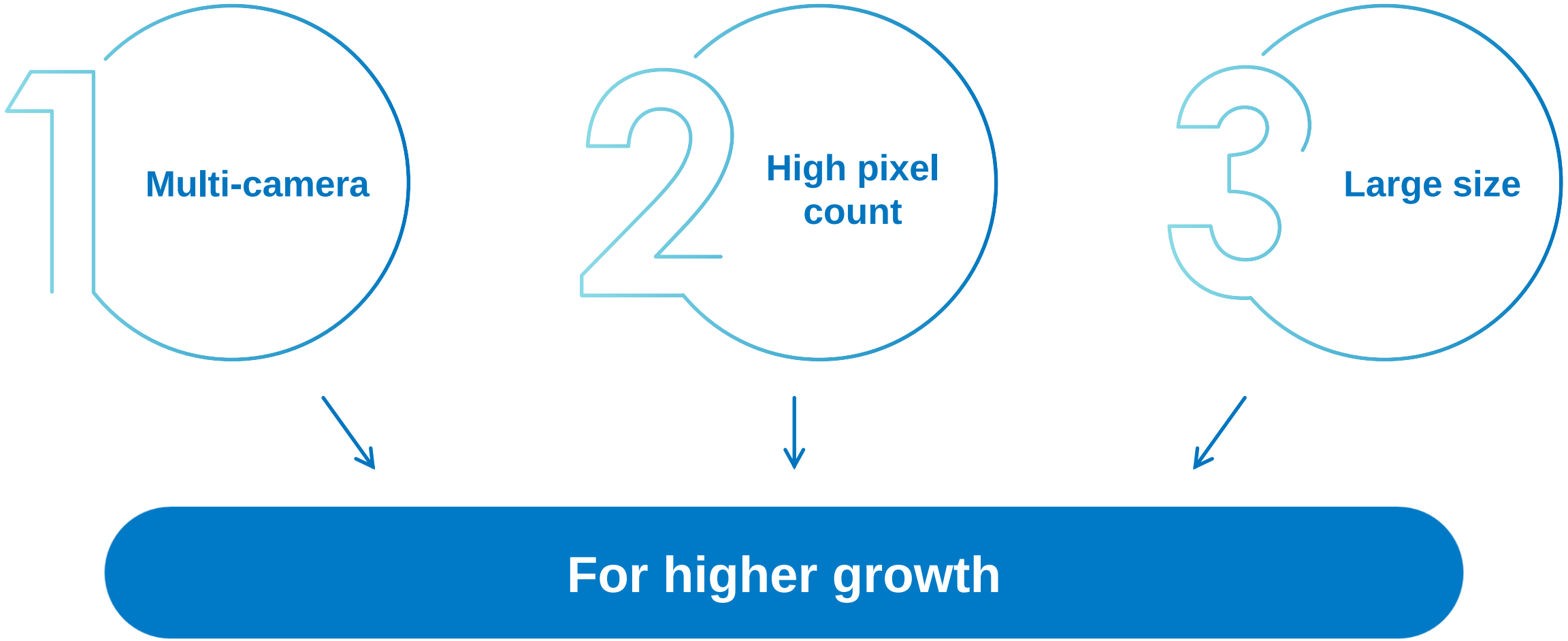
Target Area for Iupizeta™ EP (Refractive Index and Abbe's Number)



Note: COC: Cycloolefin copolymer; COP: Cycloolefin polymer

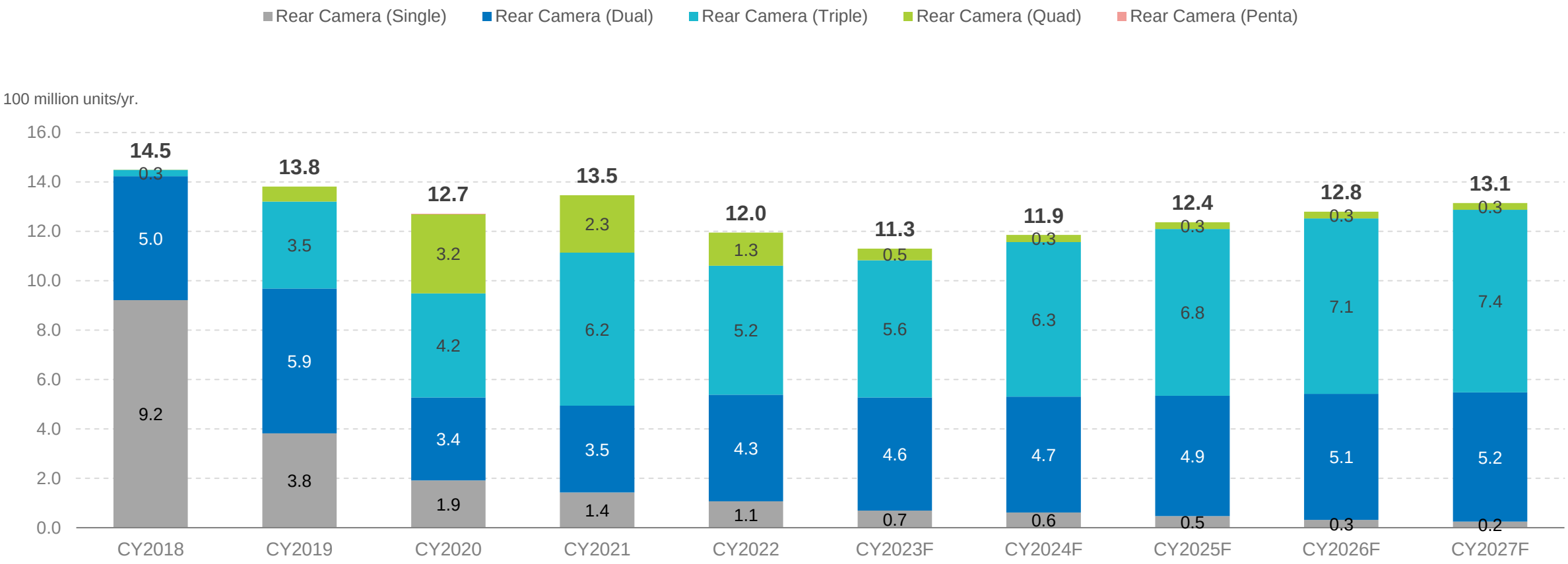
Factors Driving Iupizeta™ EP Growth

– **Three trends** in smartphone cameras



Multi-Camera Smartphone Trend (Shipment Volume Per Rear Camera)

- Smartphones built with two or more cameras now account for about 90% of all shipments.
- The multi-camera trend will likely continue to grow at a moderate pace.

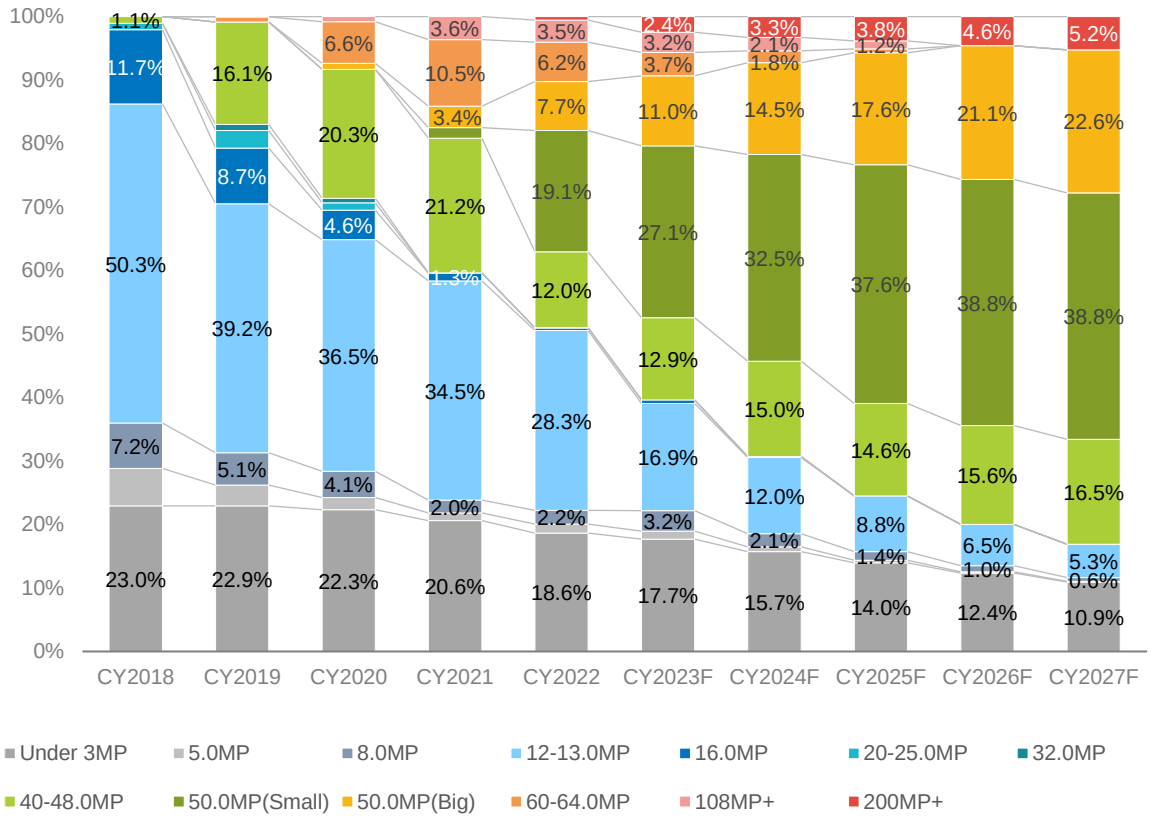


Source: Techno Systems Research materials published June 2023

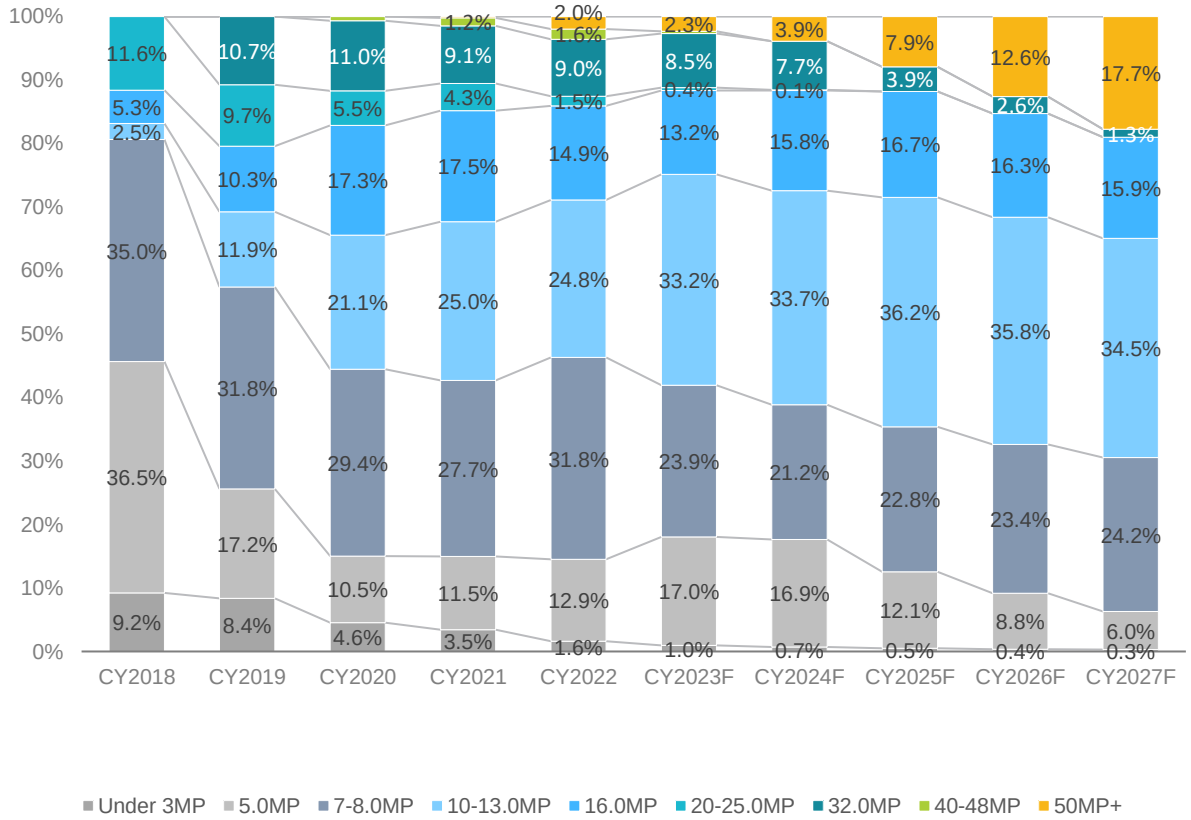
High-Pixel Smartphone Camera Trend

- **Rear main camera:** Growth of cameras with 40MP and higher (especially 50MP small and big cells) has been evident since 2022.
- **Front main camera:** Growth of cameras with 32MP and higher has been evident since 2022.

Rear main camera



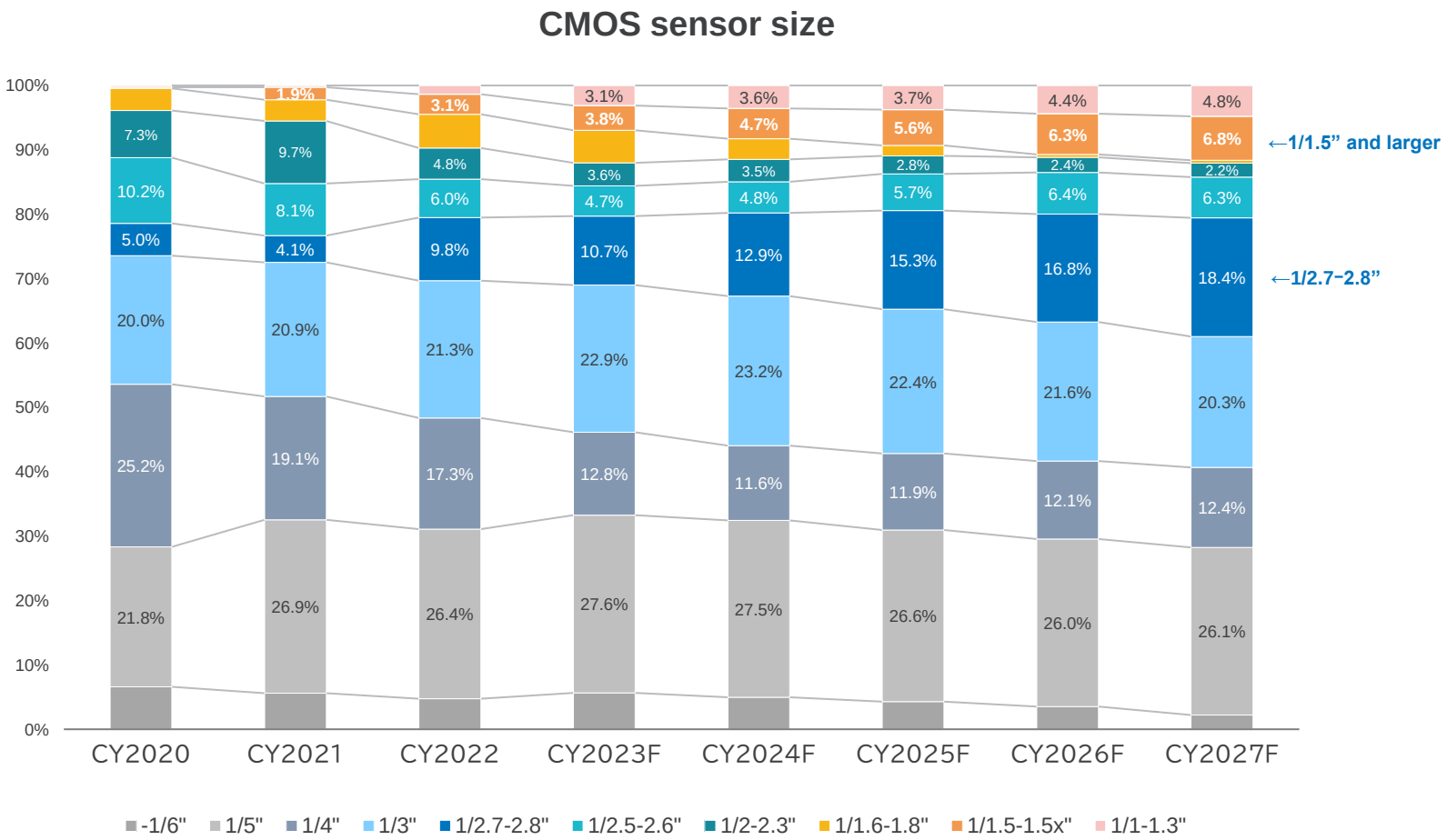
Front main camera



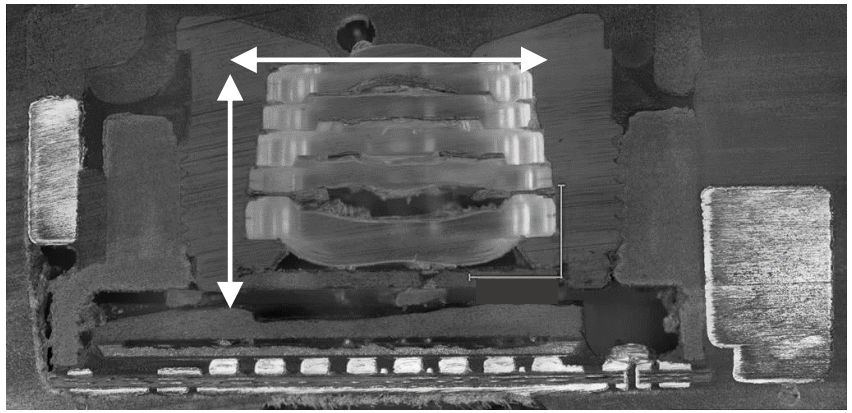
Source: Techno Systems Research materials published June 2023

Large CMOS Sensor Trend

- Along with increasing size of rear main cameras for higher **image quality**, CIS in the size range of **1/1.5” and larger and between 1/2.7-2.8”** are increasing.
- Some high-end models have telephoto and ultrawide-angle cameras with large CIS.



CIS: CMOS image sensor



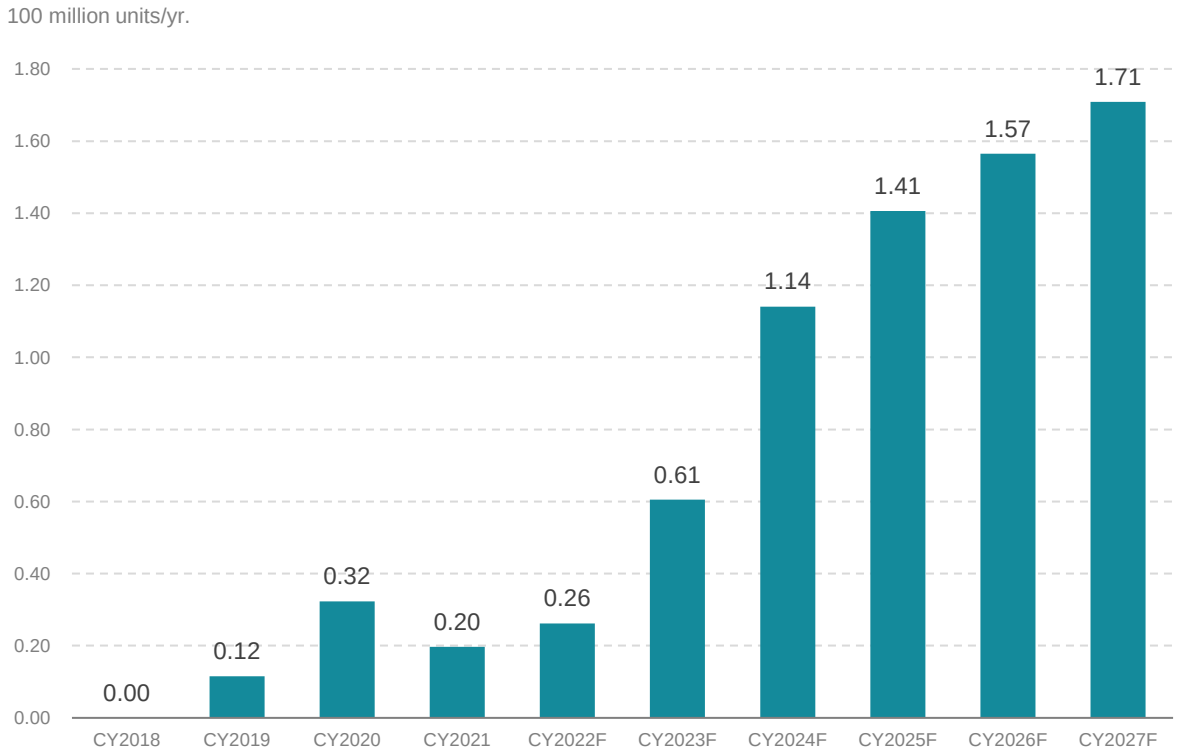
Larger CIS

Because larger CIS adds thickness to the camera module, high-refraction materials that make smartphones thinner will play more important roles than ever.

Source: Techno Systems Research materials published June 2023

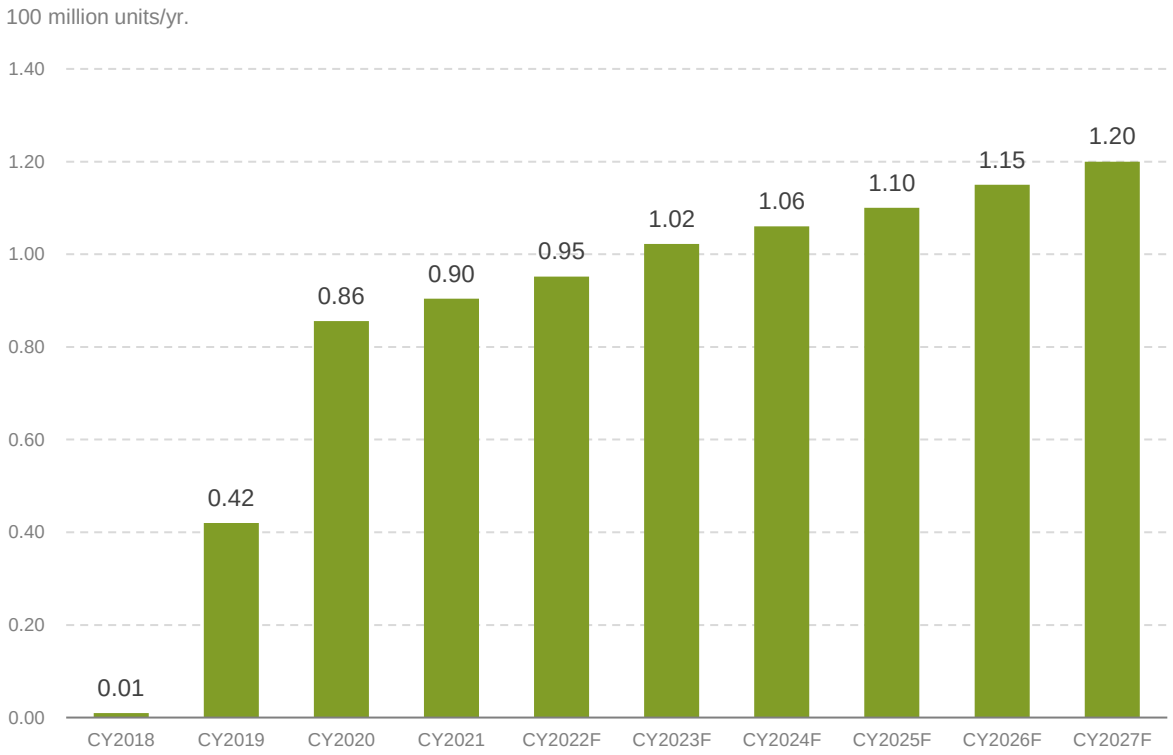
Higher-Performance Smartphone Trend (with Periscope Camera/TOF Sensor)

Periscope CCM

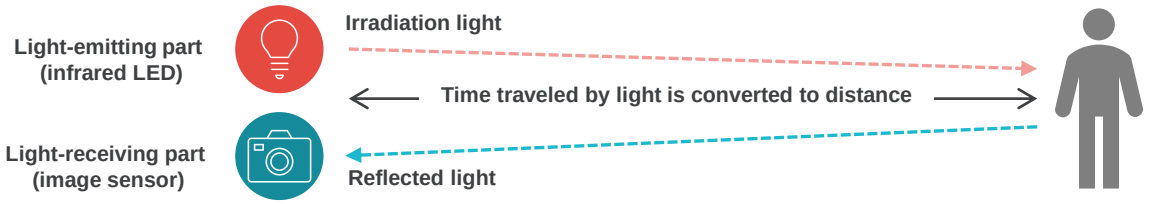


Source: Techno Systems Research materials published June 2023
(Note: The graph shows the number of smartphones shipped with periscope-camera modules.)

Rear TOF

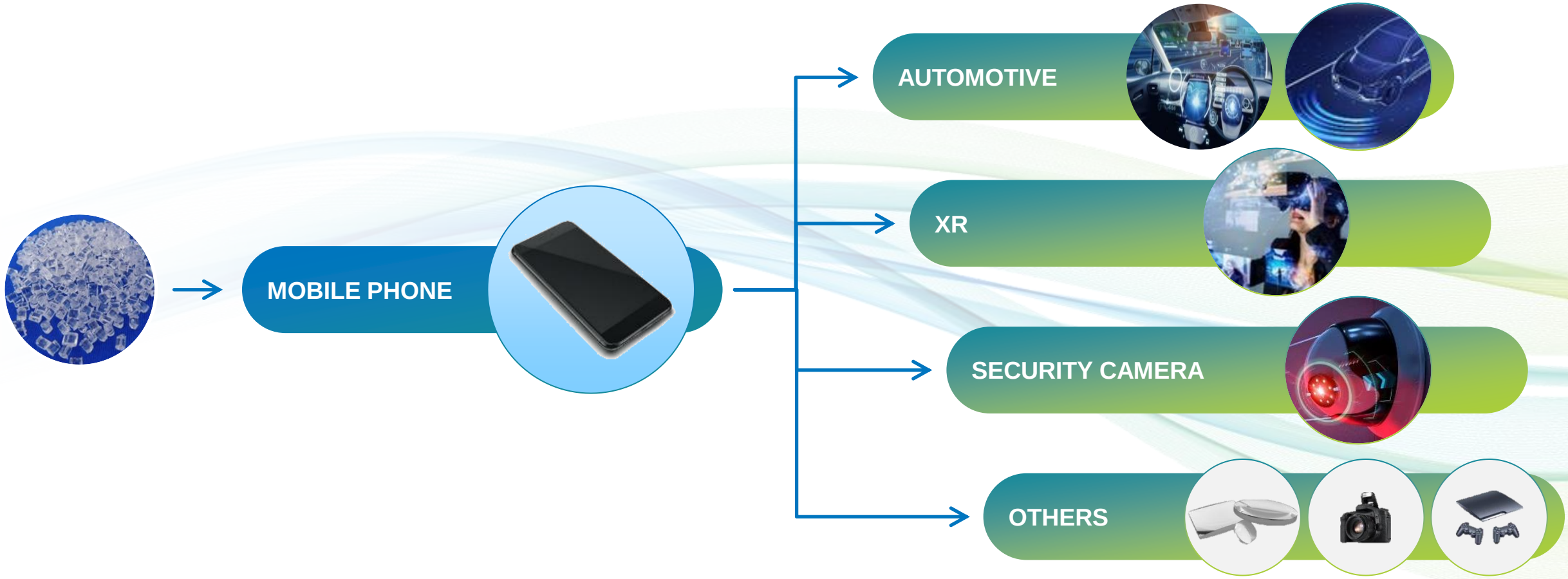


Source: Techno Systems Research materials published June 2023
(Note: The graph shows the number of smartphones shipped with rear TOF sensors.)

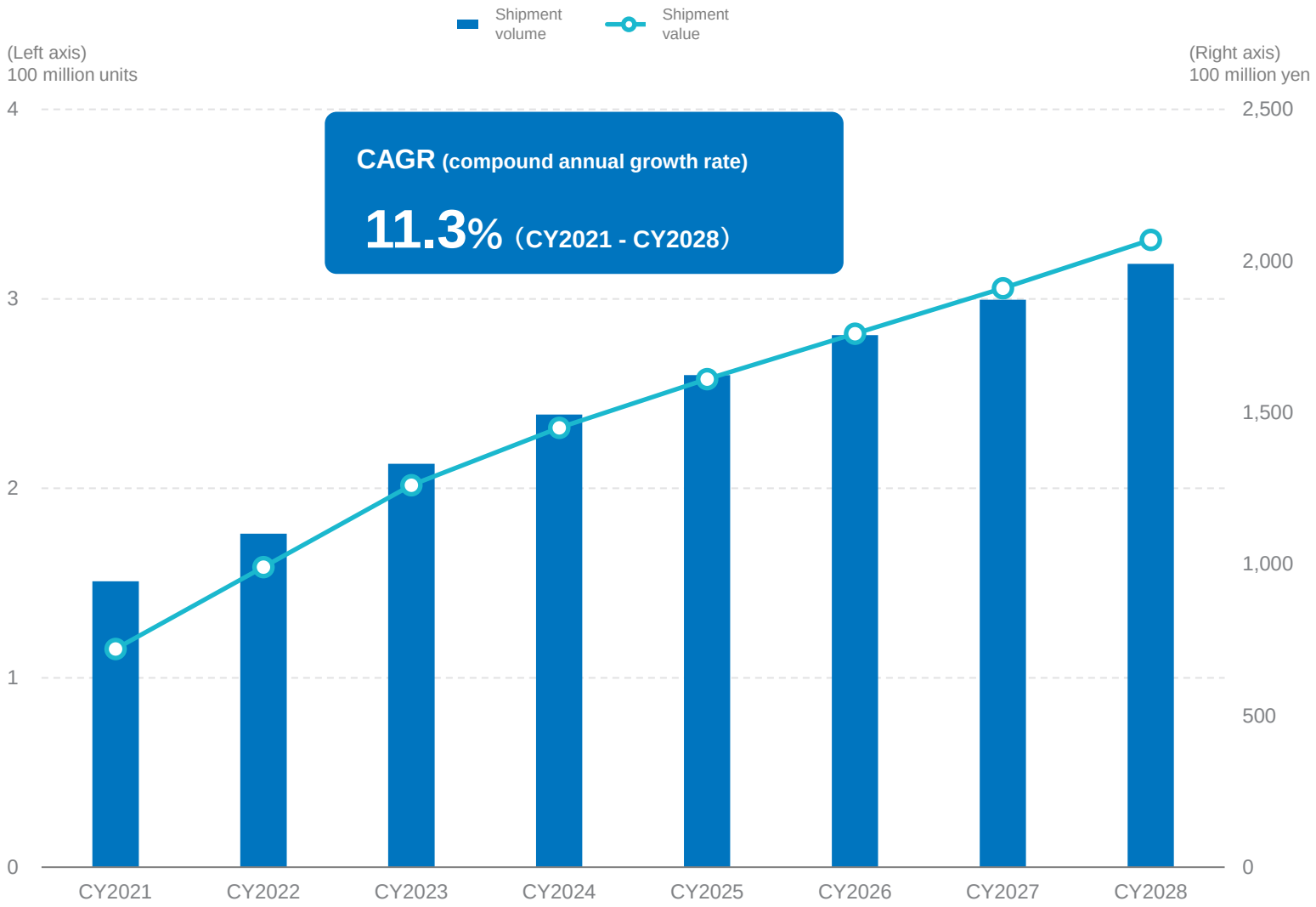


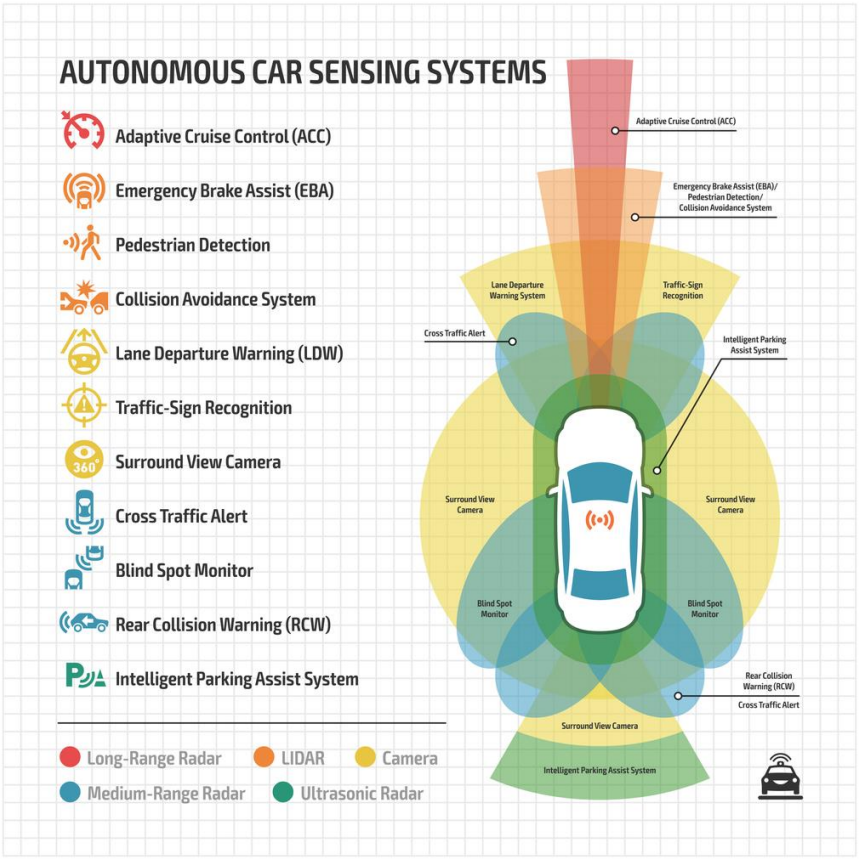
Expansion of Iupizeta™ EP Applications

- Over 90% of current demand is for smartphones, but demand for other applications, such as XR, automotive and security cameras, will grow in the future.



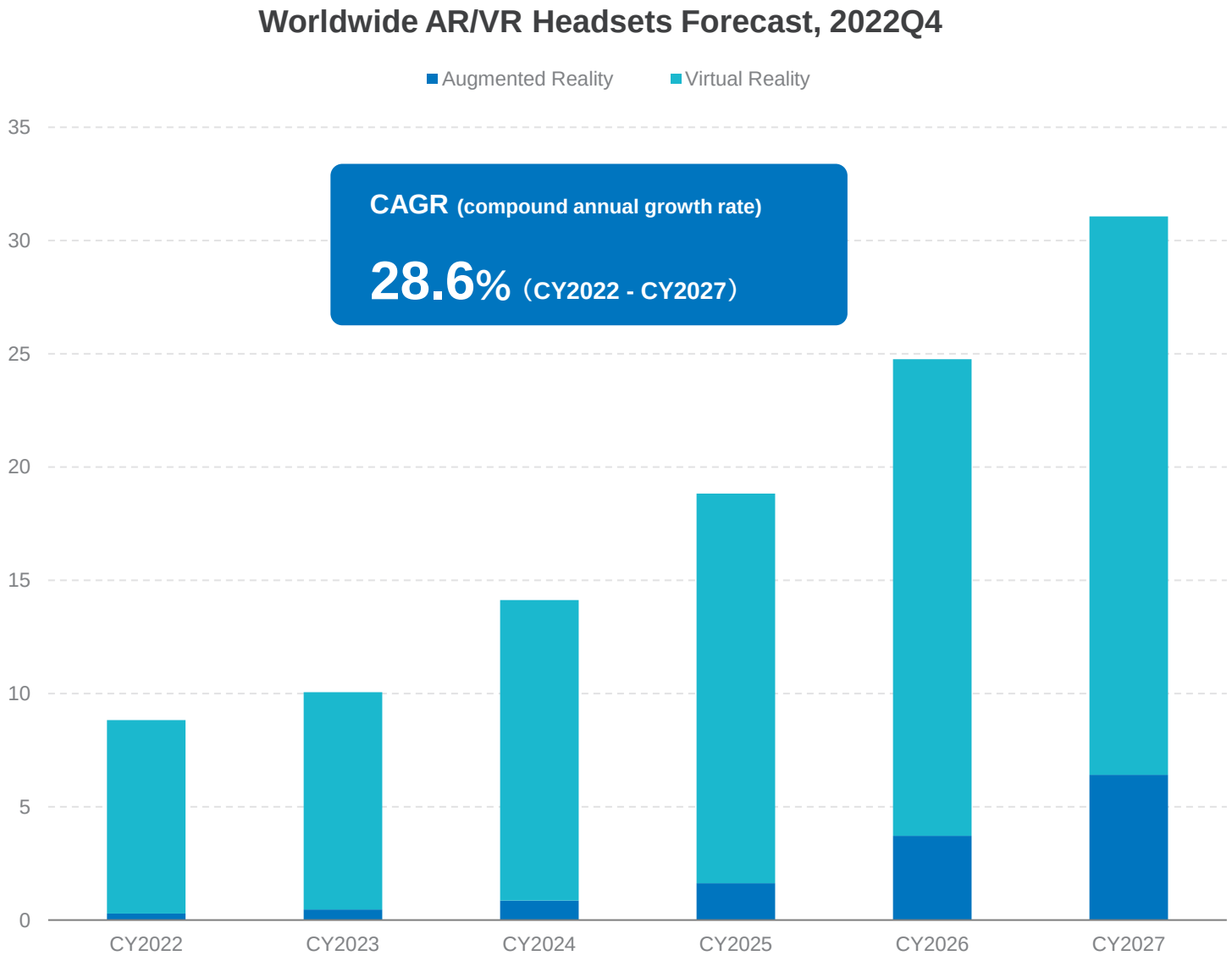
Market Projection for Other Applications (1): Lens Units for In-Vehicle Cameras





Source: Fuji Chimera Research Institute materials

Market Projection for Other Applications (2): AR/VR Headsets



Source: IDC, 2022

For Further Business Expansion

– While expanding optical applications, we are working to develop fundamental and elemental technologies that can facilitate new functions in demand outside the smartphone market.

Transesterification special PC

Monomer development

TS

DX

Special PC by interfacial polymerization method

Molding technology

Separation technology

High refractive index materials

Middle refractive index materials

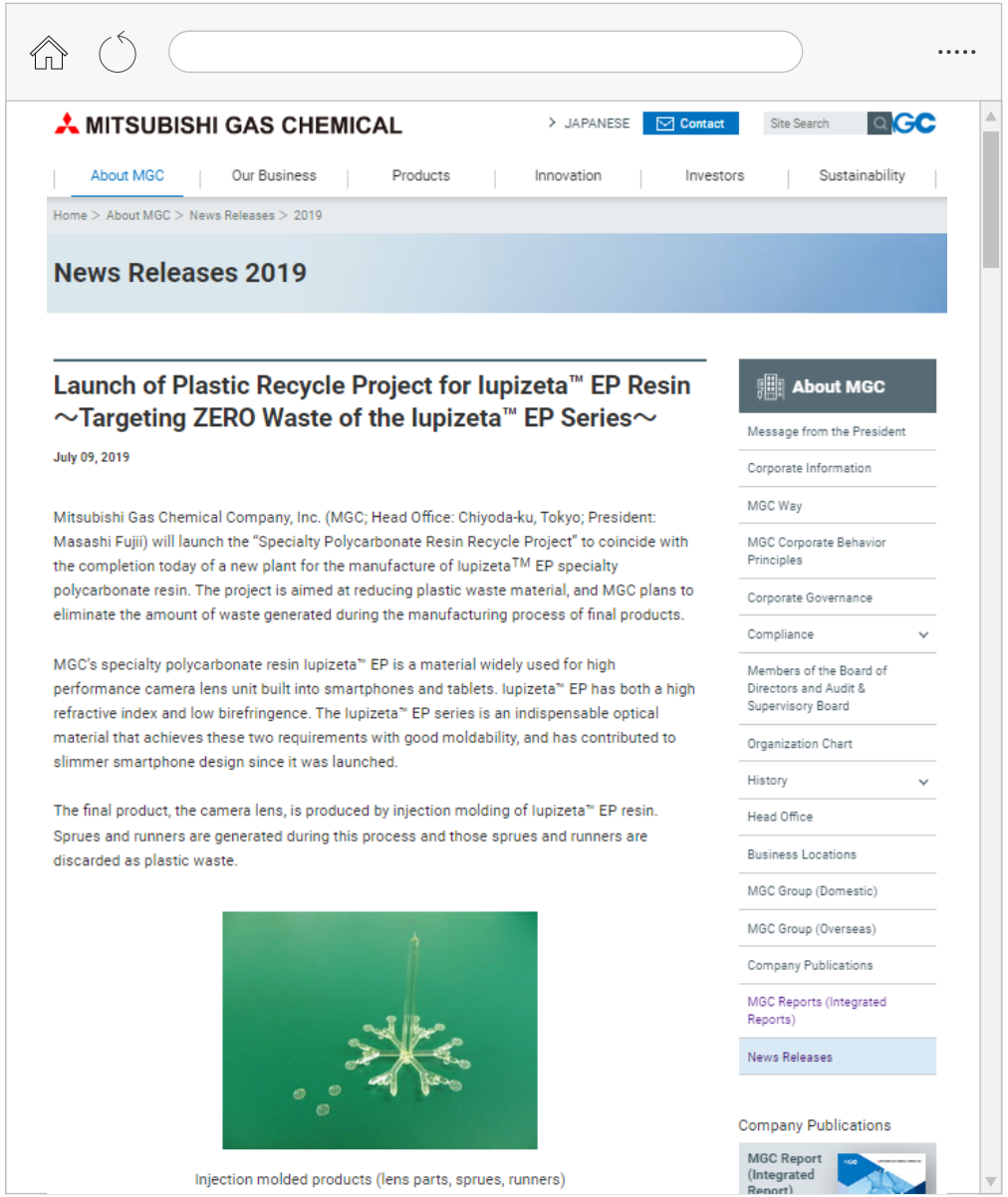
Glass alternative

Recycled materials

2. Optical Resin/Polymer

(2) Recycling Initiative

Recycling Iupizeta™ EP



MITSUBISHI GAS CHEMICAL

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News Releases 2019

Launch of Plastic Recycle Project for Iupizeta™ EP Resin
～Targeting ZERO Waste of the Iupizeta™ EP Series～

July 09, 2019

Mitsubishi Gas Chemical Company, Inc. (MGC; Head Office: Chiyoda-ku, Tokyo; President: Masashi Fujii) will launch the "Specialty Polycarbonate Resin Recycle Project" to coincide with the completion today of a new plant for the manufacture of Iupizeta™ EP specialty polycarbonate resin. The project is aimed at reducing plastic waste material, and MGC plans to eliminate the amount of waste generated during the manufacturing process of final products.

MGC's specialty polycarbonate resin Iupizeta™ EP is a material widely used for high performance camera lens unit built into smartphones and tablets. Iupizeta™ EP has both a high refractive index and low birefringence. The Iupizeta™ EP series is an indispensable optical material that achieves these two requirements with good moldability, and has contributed to slimmer smartphone design since it was launched.

The final product, the camera lens, is produced by injection molding of Iupizeta™ EP resin. Sprues and runners are generated during this process and those sprues and runners are discarded as plastic waste.

Injection molded products (lens parts, sprues, runners)

About MGC

- Message from the President
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- Compliance
- Members of the Board of Directors and Audit & Supervisory Board
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- MGC Group (Domestic)
- MGC Group (Overseas)
- Company Publications
- MGC Reports (Integrated Reports)
- News Releases

Company Publications

MGC Report (Integrated Report)

MGC press release, July 2019

Launch of Plastic Recycle Project for Iupizeta™ EP Resin

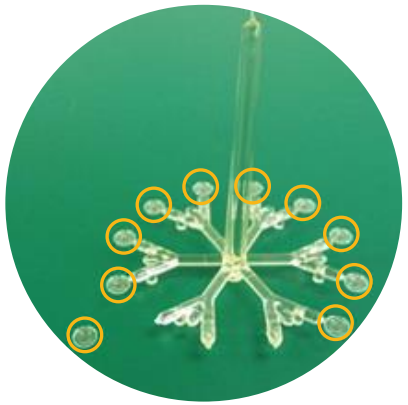
-Targeting ZERO Waste of the Iupizeta™ EP Series-

https://www.mgc.co.jp/eng/corporate/news/2019/190709e.html

Why EP Recycling Is Necessary (1): Waste Volume Is High

Lens manufacturers

Smartphone manufacturers



Less than 10% is consumed as lenses

Polymer supplies

Injection molding

Smartphone lenses

Remaining **90%** is wasted

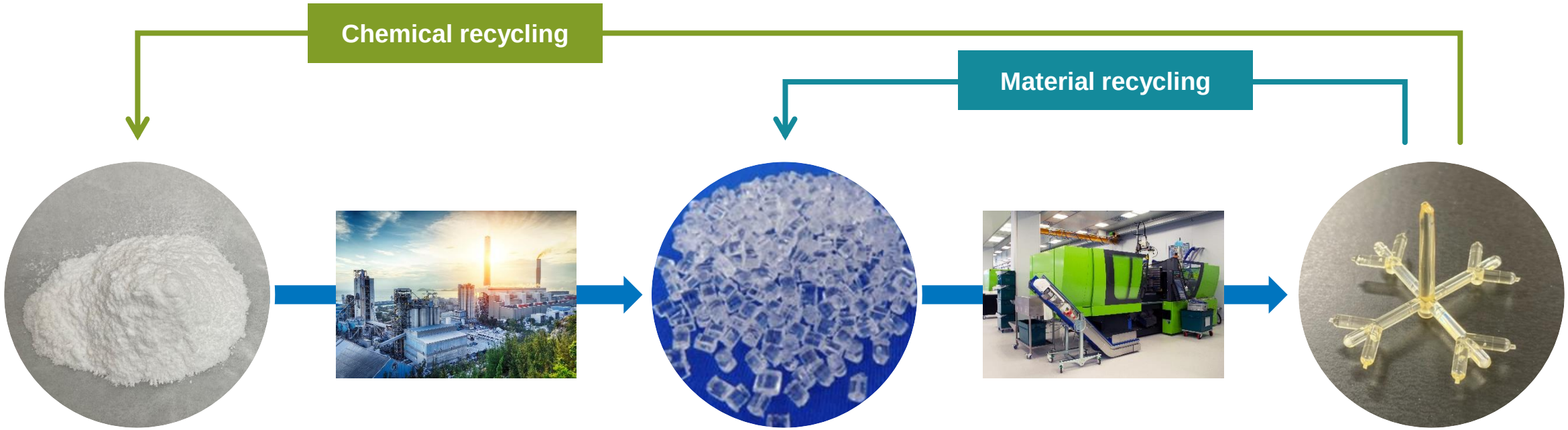
Why EP Recycling Is Necessary (2): Society Expects It

	Due	Sustainable Goals
Apple	2030	75% reduction of CO_2 emissions
Google	2030	Carbon-free operations
Meta	2030	Carbon neutrality

Iupizeta™ EP Recycling Ideas (1)

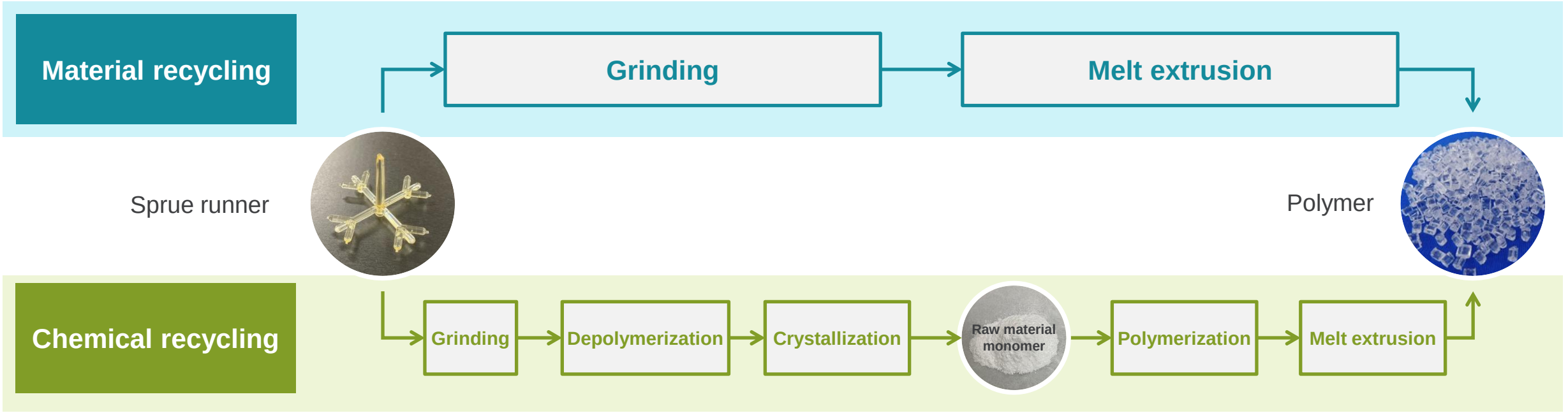
1. Injection molding, the primary method for processing plastic products, produces high volumes of scrap materials.
2. To satisfy ever-increasing social demand for sustainability, scrap plastics must be recycled.
3. Use of post-consumer recycled material for optical lenses is unrealistic because they must have high transparency and quality.

→So we thought about pre-consumer recycling of plastic scrap generated in our customers' production processes.



Iupizeta™ EP Recycling Ideas (2)

– Every recycling method has pros and cons. We choose the best method for each scrap material state to be recycled.



	Number of processes	Cost	Influence of resin deterioration
Material recycling	Few ○	Low ○	Large ×
Chemical recycling	Many ×	High ×	Small ○

MGC Ideals for the Future: Performance and Sustainability

Sustainable

Technologies contributing to sustainable society
- Material-recycling technology
- Chemical-recycling technology
- Advanced selection technology

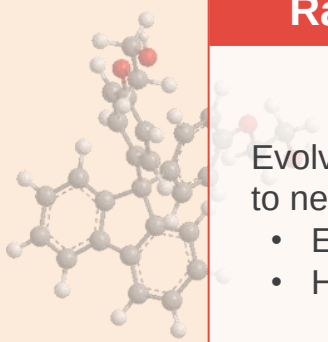
2030 Future

Project the Future with Sustainable Lens

New Monomers & Technologies

Ⅰ Ⅱ Ⅲ

Existing technology



Raising performance levels

Evolving performance levels to contribute to next generation of lenses
- Evolving optical properties
- Higher stability of lens dimensions

3. Ophthalmic Lens Monomer

IURESIN™ Ophthalmic Lens Monomer

– MGC specializes in materials with ultrahigh refractive index: 1.70, 1.74 and 1.76.

IURESIN

- 1.76 is the world's highest refractive index for plastic lenses.
- It can be 50% thinner than commonly used plastic lenses in world market.

Note: Courtesy of Tokai Optical Co., Ltd.

These thinner lenses can correct even high myopia, are much easier to wear, and help expand the available choices of frames as fashion items.

Ophthalmic Lens Supply Chain

– As a materials manufacturer, MGC produces and sells materials for ophthalmic lenses.

Monomers and other materials

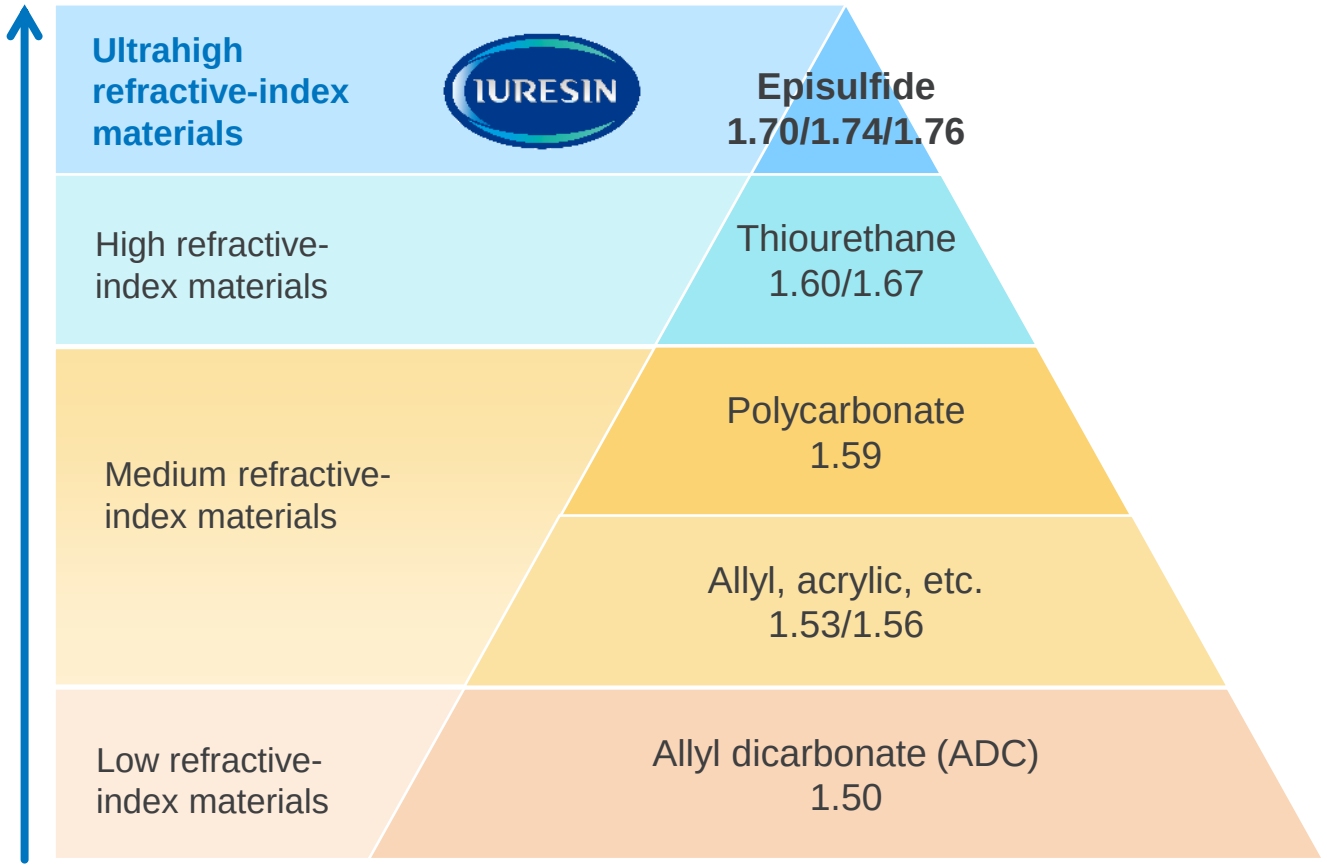
Mold the materials into ophthalmic lenses
Polishing, coating and special processing

Cut the lenses to fit the frames

Materials manufacturers MGC → **Ophthalmic lens manufacturers** → **Eyeglass retailers** → **Consumers**

Ophthalmic Lens Material Markets (by Refractive Index)

- MGC produces ophthalmic lens materials (mainstay refractive index of 1.74) at the Naniwa Plant (Taisho-ku, Osaka City)
- Lenses with refractive index of 1.70 and higher make up only a few percent of the total lens market, creating a niche market for high value-added products.

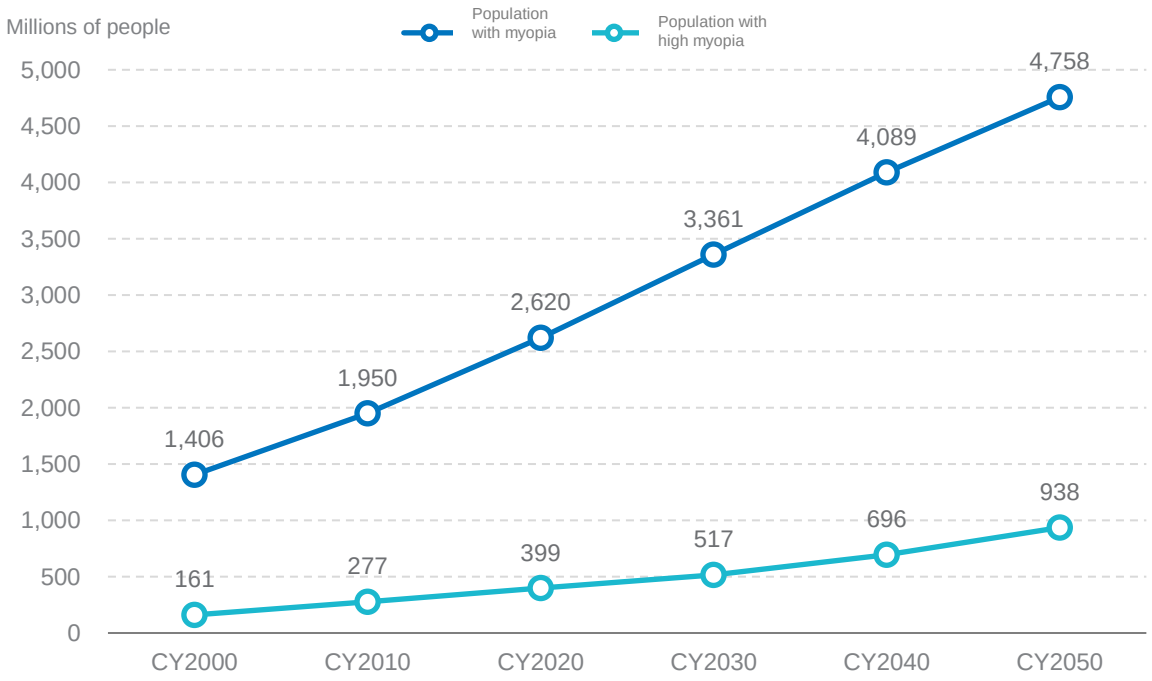


Naniwa Plant, Taisho-ku, Osaka City

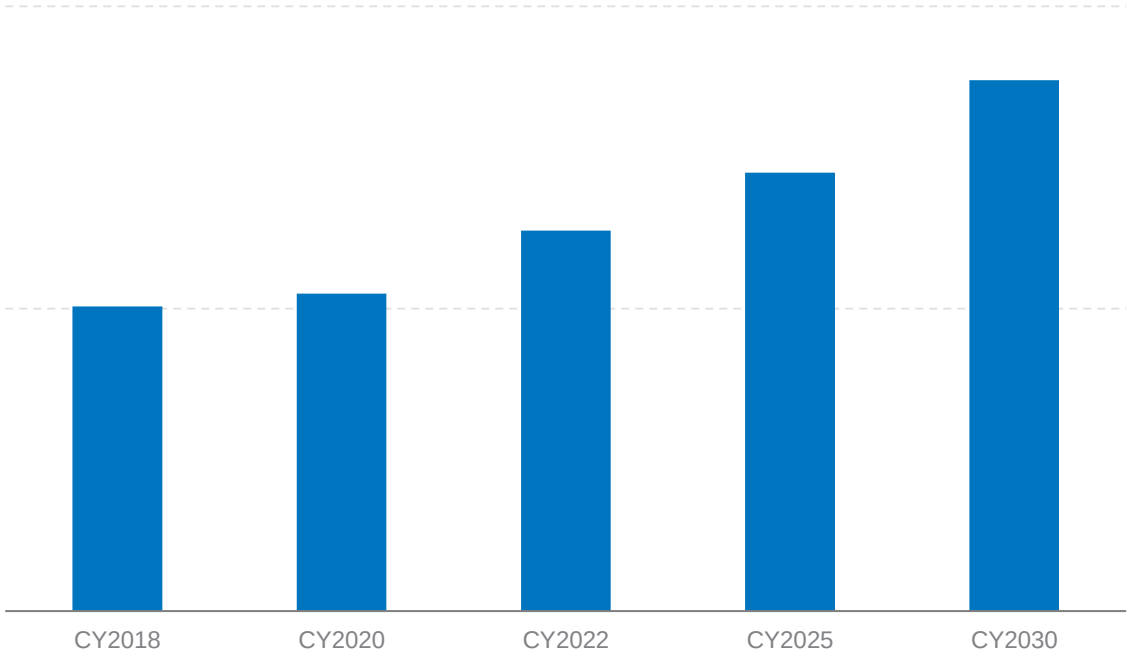
Background of Ophthalmic Lens Material Market Growth

- The numbers of people with myopia will keep growing considerably worldwide, and the vision-correction market will continue to expand.
- We project that demand for ophthalmic lenses with ultrahigh refractive index of 1.70 and higher will continue to grow to serve people with high myopia and the better off.
- Despite COVID-19, the market resettled into a growth trend in 2020, showing annual growth of close to 10% up to 2023. We project continuing growth by about 5% annually.

Projected trend of population with myopia and high myopia worldwide



Ultrahigh refractive-index ophthalmic lens material market (MGC projection)



Source: *American Academy of Ophthalmology* Vol. 123, May 2016

Disclaimer

This document has been translated from the Japanese original for reference purpose only. In the event of any discrepancy between this translated document and the Japanese original, the original shall prevail.

This document contains performance forecasts and other statements concerning the future. These forward-looking statements are based on information available at the time. These materials were prepared and on certain premises judged to be reasonable. None of these forward-looking statements are intended to be guarantees of future performance. Various factors may cause actual performance to differ significantly from forecasts.