Introduction to Asahi Kasei's Engineering Plastics

Contents

Corporate Configuration

Centered on the operating holding company Asahi Kasei Corp. and seven core operating companies, the Asahi Kasei Group dose business in the three sectors of Material, Homes, and Health Care.

Asahi Kasei Corporation — Holding company function

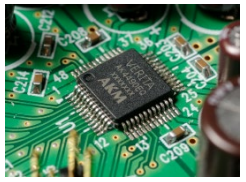
Material

Operating function
- Environmental Solutions
- Mobility & Industrial
- Life Innovation
- Asahi Kasei Microdevices Corp.

Homes
- Asahi Kasei Homes Corp. — Homes
- Asahi Kasei Construction Materials Corp. — Construction Materials

Health Care
- Asahi Kasei Pharma Corp. — Pharmaceuticals
- Asahi Kasei Medical Co., Ltd. — Medical Care
- ZOLL Medical Corporation — Acute Critical Care
- Veloxis Pharmaceuticals, Inc. — Pharmaceuticals



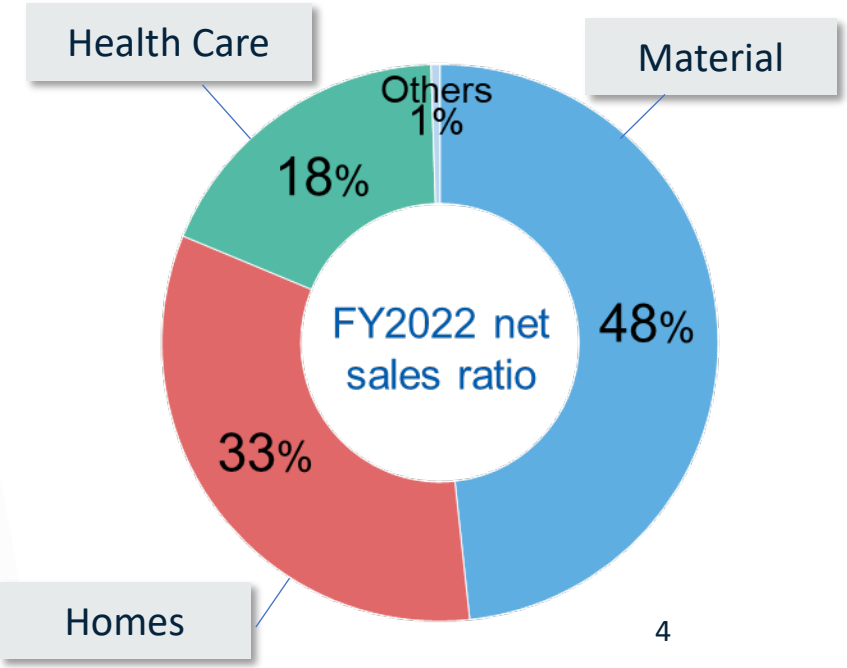




Financial highlights

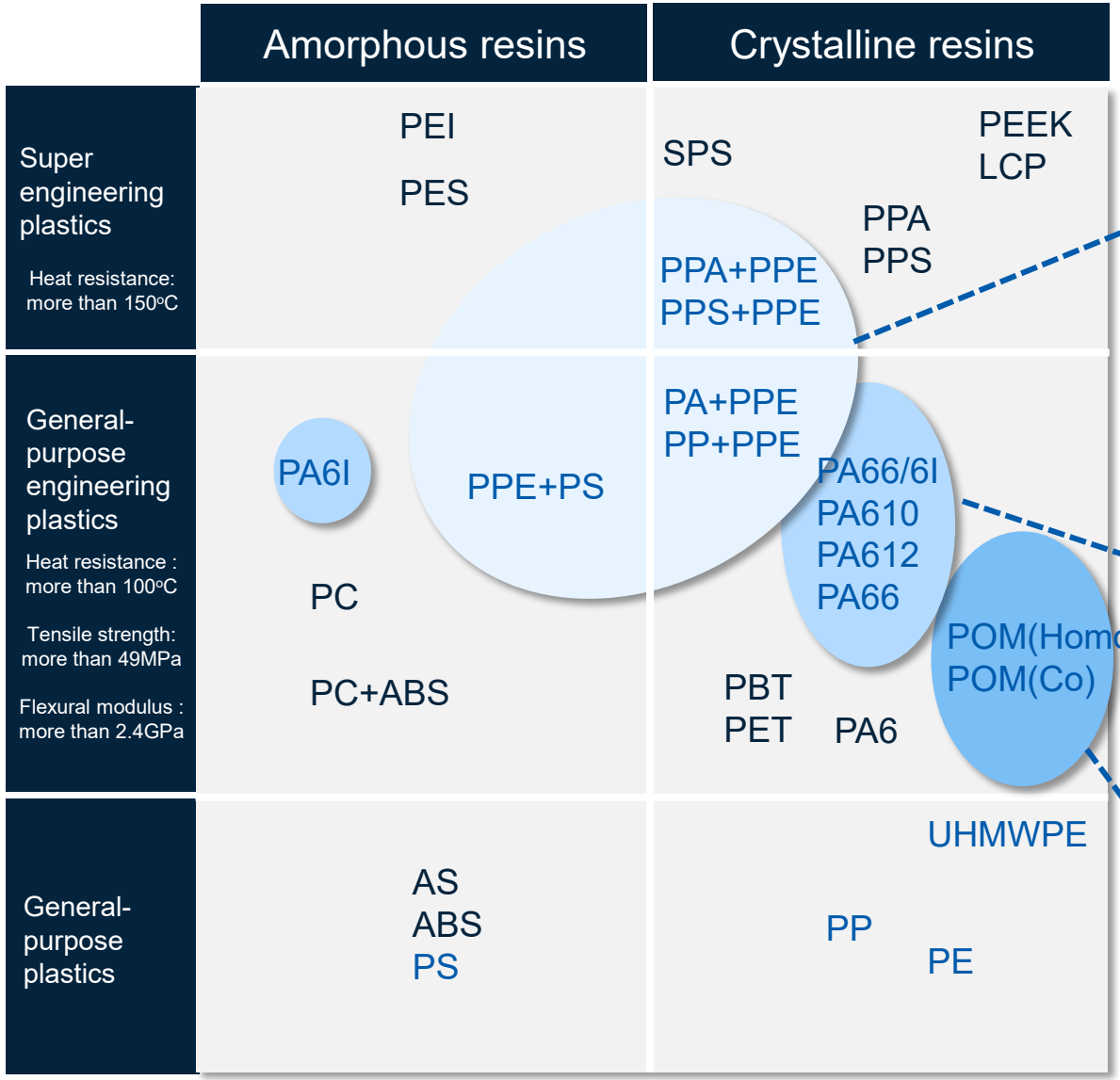
Net sales ¥2,726.5 billion ($20.4 billion)

Operating income ¥128.4 billion ($1.0 billion)



Asahi Kasei's Engineering Plastics Overview

Asahi Kasei's Engineering Plastics



*Blue letters: Plastics manufactured and sold by Asahi Kasei

m-PPE Resin

XYRON™

- Contributes to product weight reduction and high precision
- World's No. 2 manufacturer* of PPE resin

m-PPE Foamed Beads SunForce™

LENCEN™ (c-GFRTP)

Polyamide Resin

LEONA™

- Excellent heat resistance, strength and stiffness
- Asia's No. 1 manufacturer* of PA66 resin

Polyacetal Resin

TENAC™

- Excellent sliding properties, toughness and fatigue properties
- World's only manufacturer* of both homopolymers and copolymers

*Source: Fuji Keizai's 2023 Engineering Plastics Market Outlook and Global Strategies

Sites

Europe

- Asahi Kasei Europe GmbH (Germany)
- Processing contractor (Germany)
- Processing contractor (France)

Japan

- Sales & Marketing Dept. (Tokyo, Nagoya)
- Performance Plastics Application Development Promotion Dept. (Kawasaki)
- Production of Polyamide resin (Nobeoka)
- Nobeoka Plastics Processing Co., Ltd.
- Production of Polyacetal resin (Mizushima)
- Asahi Kasei Color Tech Co., Ltd. (Tochigi)

North America

- Asahi Kasei Plastics North America, Inc. (Michigan, Alabama)
- Asahi Kasei Plastics Mexico S.A. de C.V.

Asia

- Asahi Kasei Plastics (Shanghai) Co., Ltd.
- Asahi Kasei Plastics (Guangzhou) Co., Ltd.
- Asahi Kasei Plastics (Hong Kong) Co., Ltd.
- Asahi Kasei Plastics (CHANGSHU) CO.,LTD
- Asahi Kasei POM (Zhangjiagang) Co., Ltd.
- Processing contractor(China)

- Asahi Kasei Plastics Singapore Pte. Ltd.
- Asahi Kasei Plastics (Thailand) Co., Ltd.
- Asahi Kasei Plastics Vietnam Co., Ltd.
- Processing contractor(Malaysia)
- Processing contractor(Indonesia)
- Processing contractor(India)
- Processing contractor(Vietnam)

Sale and technical support / In-house factory / Processing contractor

Polyamide Resin LEONA™

Key Features of LEONA™

1 Heat resistance

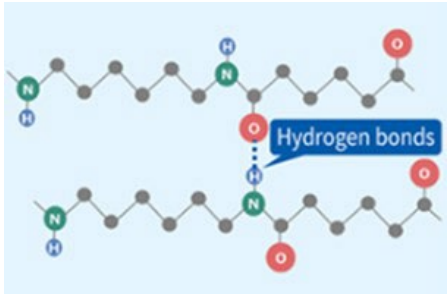
Comparison with crystalline resins (non-reinforced)

Crystalline resins	LEONA™ PA66	PA6	PET	PBT
Melting point (°C)	265	225	256	227

- PA66 resins have a high melting point in general-purpose engineering plastics and boast excellent heat resistance.

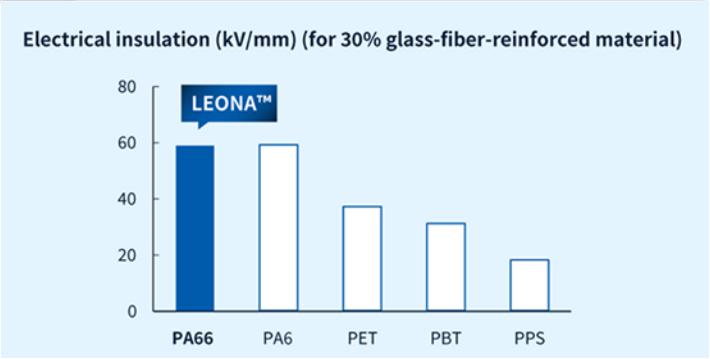
2 Mechanical properties

Crystalline structure



- PA66 resins feature excellent strength and rigidity due to hydrogen bonds acting between molecules.

3 Electrical insulation



- PA66 resins feature excellent electrical insulation and tracking resistance.

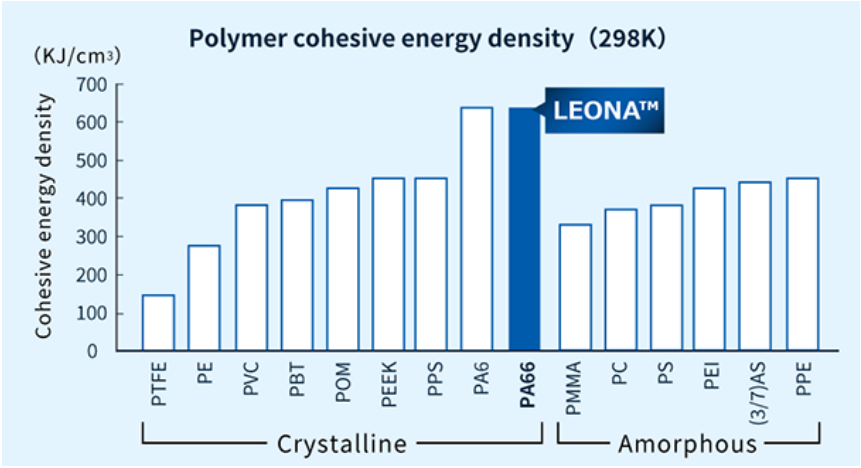
4 Resistance to oil and organic solvents

Water / alcohols		Hydrocarbons		Organic acids	
Water	Good	Paraffins	Excellent	Formic acid 85%	None
Methanol	Good	Benzene	Excellent	Acetic acid 40%	None
Ethanol	Good	Toluene	Excellent	Benzoic acid	None
Propanol	Good	Xylene	Excellent	**Inorganic acids**	
Butyl alcohol	Excellent	Cyclohexane	Excellent	Hydrochloric acid 2%	None
Ethylene glycol	Excellent	**Halogen compounds**		Sulfuric acid 2%	None
Glycerin	Excellent	Methylene chloride	Good	Nitric acid 2%	None
Benzyl alcohol	Good	Chloroform	Good	Chromic acid 10%	None
Aldehydes / ketones		Trichloroethylene	Excellent	**Inorganic bases**	
Formalin	Good	Perchloroethylene	Excellent	Sodium hydroxide 50%	Good
Acetoaldehyde	Good	Carbon tetrachloride	Excellent	Aqueous ammonia 10%	Good
Benzaldehyde	Good	**Phenols**		Potassium hydroxide 50%	Good
Acetone	Excellent	Phenol	None	**Inorganic substances**	
Methyl ethyl ketone	Excellent	Resorcinol	None	Sodium carbonate 10%	Excellent
Oils		**Esters**		Sodium chloride 10%	Excellent
Gasoline	Excellent	Ethyl acetate	Excellent		

【Rankings】 Excellent : Almost no change in dimensions or weight
Good : Some change in dimensions or weight
Fair : Some degree of penetratio
None : Extensive penetration or dissolution
【Conditions】 at20°C

- PA66 resins feature excellent resistance to non-acid chemicals, organic solvents, lubricant oils, and similar substances.

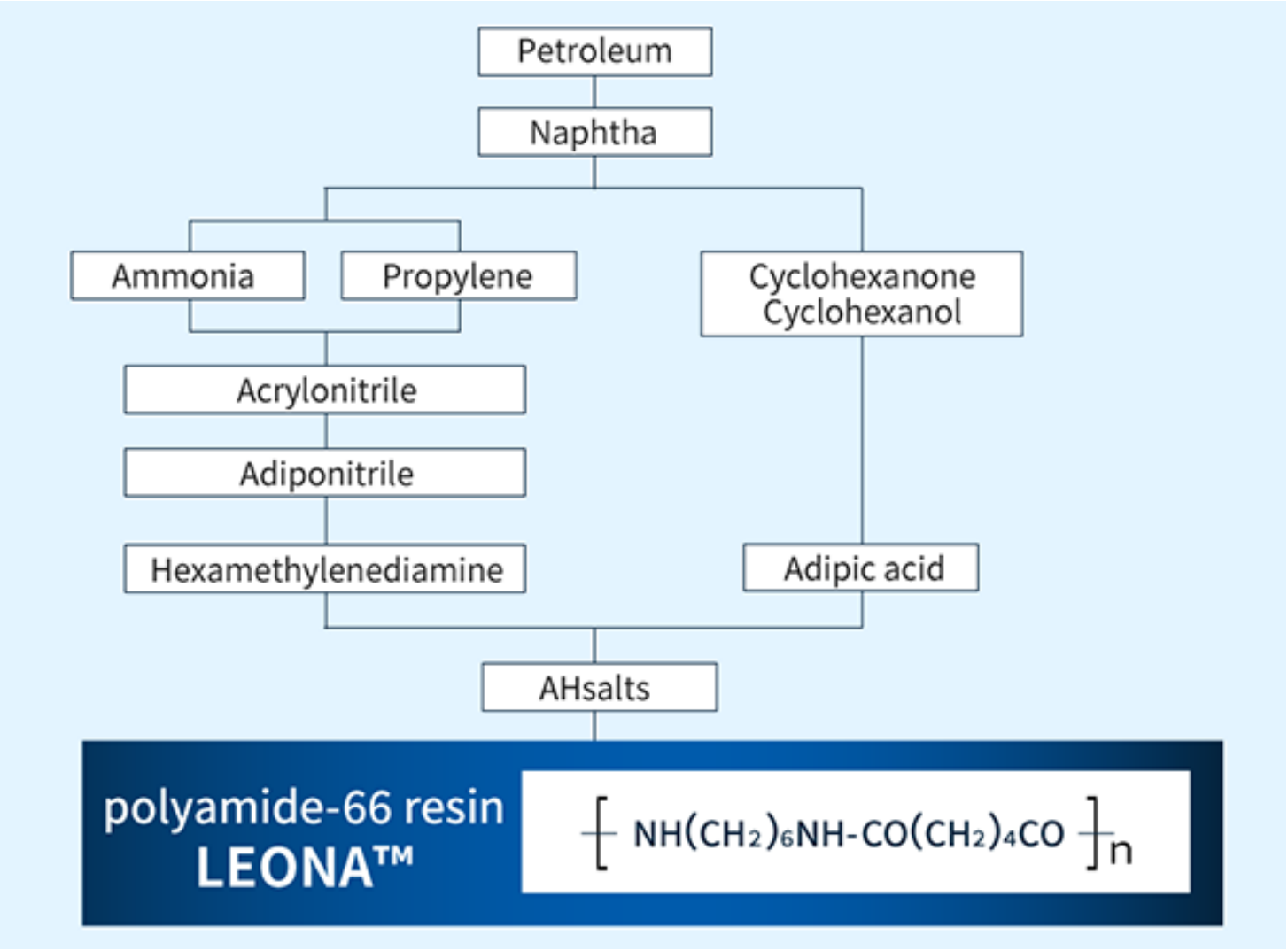
5 Fillers for strength reinforcement



- PA66 resins have a high cohesive energy density, so they can be reinforced with a larger amount of fillers to enhance various performance characteristics.

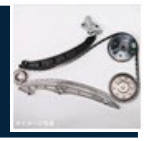
Reasons for choosing LEONA™

Entirely in-house production from intermediates to finished products.



Our fully in-house production process minimizes external disruptions to reduce supply instability.

Product grades

S series		Highly attractive surfaces / High strength upon water absorption / Good flowability / Good long-term creep behavior / Flame retardance (SH, SN series)
90G, 91G series		Highly attractive surfaces / High mechanical strength / Good flowability / Can eliminate painting steps in production processes / Low mold temperatures / Weather resistance
FR series		Flame resistance (UL94 V-0) / Minimal mold deposits / Good formability / Toughness (FR200) / Good glow-wire properties (FR650)
FG series		V-0 level flame retardance (halogen-based) / Excellent wear resistance / Minimal mold deposits / Excellent corrosion resistance
Low friction/low wear material 1442, 1542		Self-lubricating properties / High heat resistance / Excellent wear resistance / Wide range of processing temperatures
BG, 53G series		Low water absorption / Dimensional stability / Hydrolysis resistance / Resistance to LLC
High viscosity series		High viscosity / High toughness / Durability
14G series		High mechanical strength / Resistance to thermal aging / Fatigue resistance / Creep resistance

AsahiKASEI

Application Cases

The No. 1 manufacturer of PA66 resin in Japanese market*

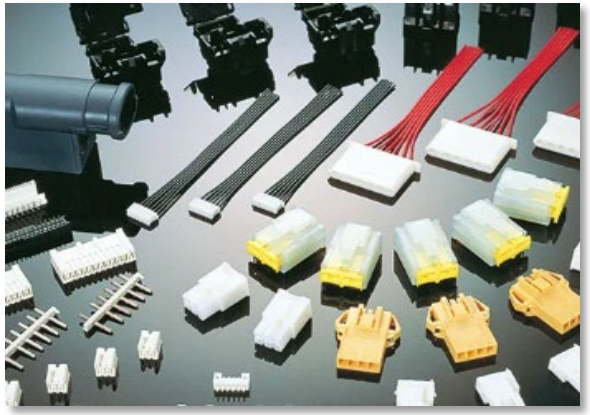
*Source: Fuji Keizai's 2023 Engineering Plastics Market Outlook and Global Strategies

Door mirror base
Good appearance / Weatherability /
High stiffness

Engine mount bracket
Heat resistance /
High strength / High stiffness

Water pipe
Heat resistance /
Hydrolysis resistance

Chain guides
Low friction, low wear /
High heat resistance



Connector
Electrical characteristics (CTI) /
Heat resistance

Solar cell connector nut
Flame retardancy /
Easy moldability

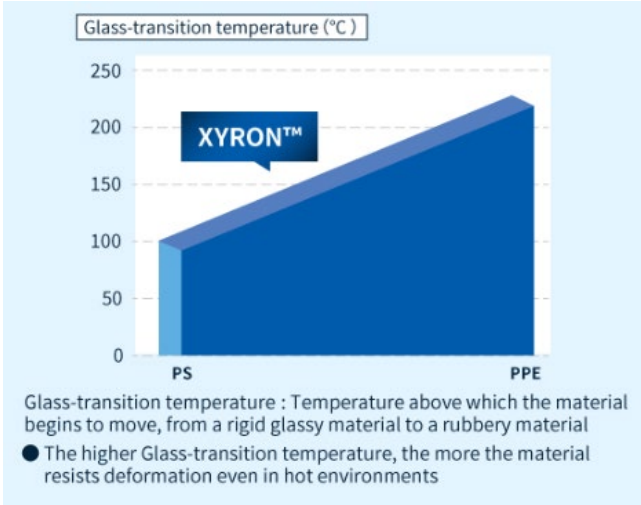
Crescent
Good appearance /
High designability

Gear box / Gear reducer
Friction & wear resistance /
High modulus

m-PPE Resin XYRON™

Key features of XYRON ™

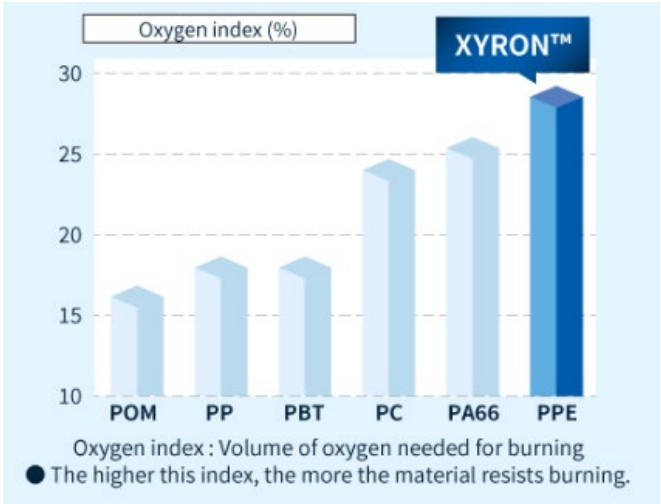
1 Heat resistance



Glass-transition temperature : Temperature above which the material begins to move, from a rigid glassy material to a rubbery material

- The higher Glass-transition temperature, the more the material resists deformation even in hot environments

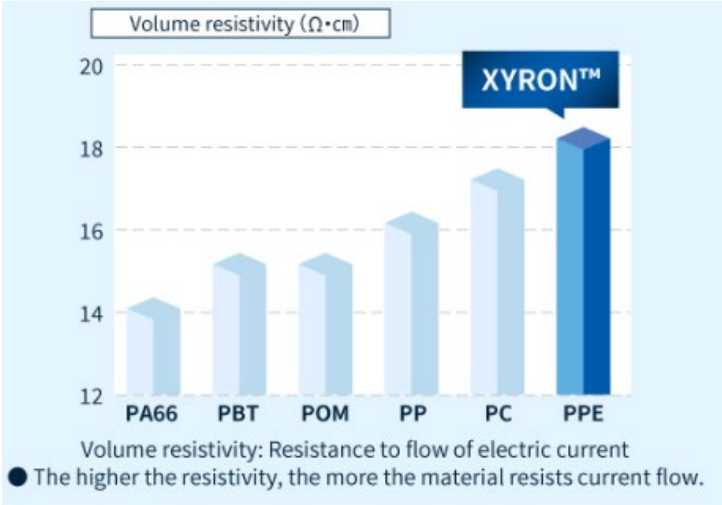
2 Flame retardancy



Oxygen index : Volume of oxygen needed for burning

- The higher this index, the more the material resists burning.

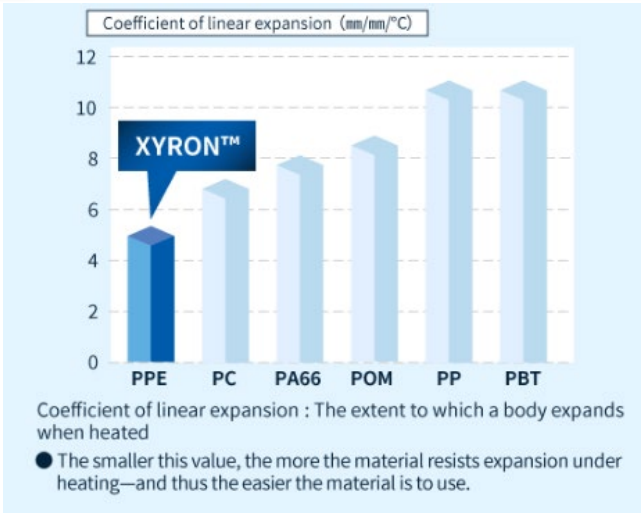
3 Electrical insulation



Volume resistivity: Resistance to flow of electric current

- The higher the resistivity, the more the material resists current flow.

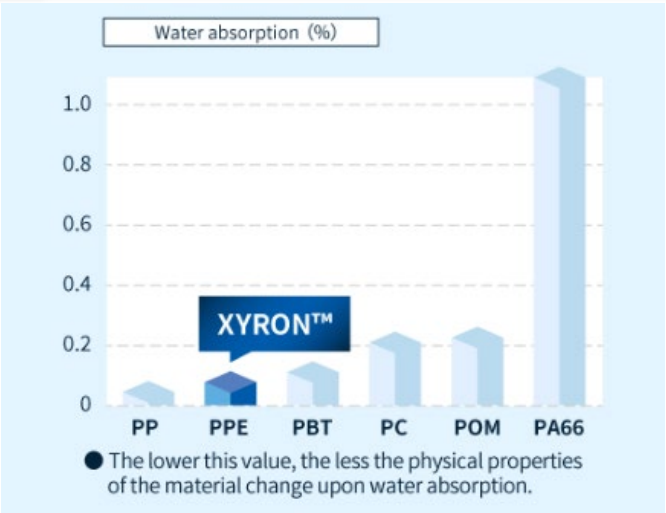
4 Dimensional stability



Coefficient of linear expansion : The extent to which a body expands when heated

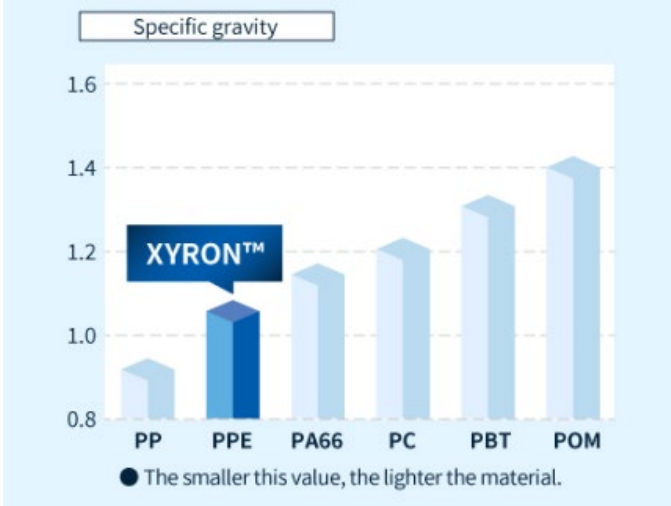
- The smaller this value, the more the material resists expansion under heating—and thus the easier the material is to use.

5 Low water absorption



- The lower this value, the less the physical properties of the material change upon water absorption.

6 Low specific gravity

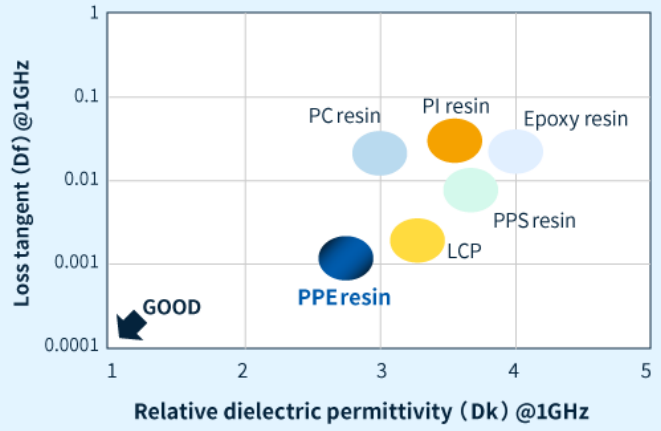


- The smaller this value, the lighter the material.

Key features of XYRON ™

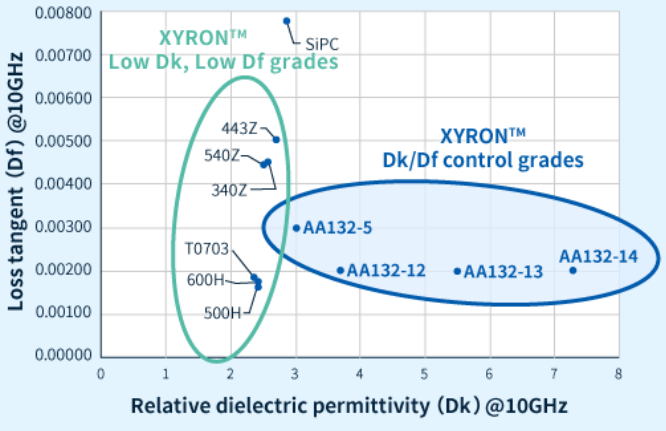
7 Low dielectric permittivity and low dielectric loss tangent

Comparison of dielectric properties of each engineering plastic (non-reinforced)



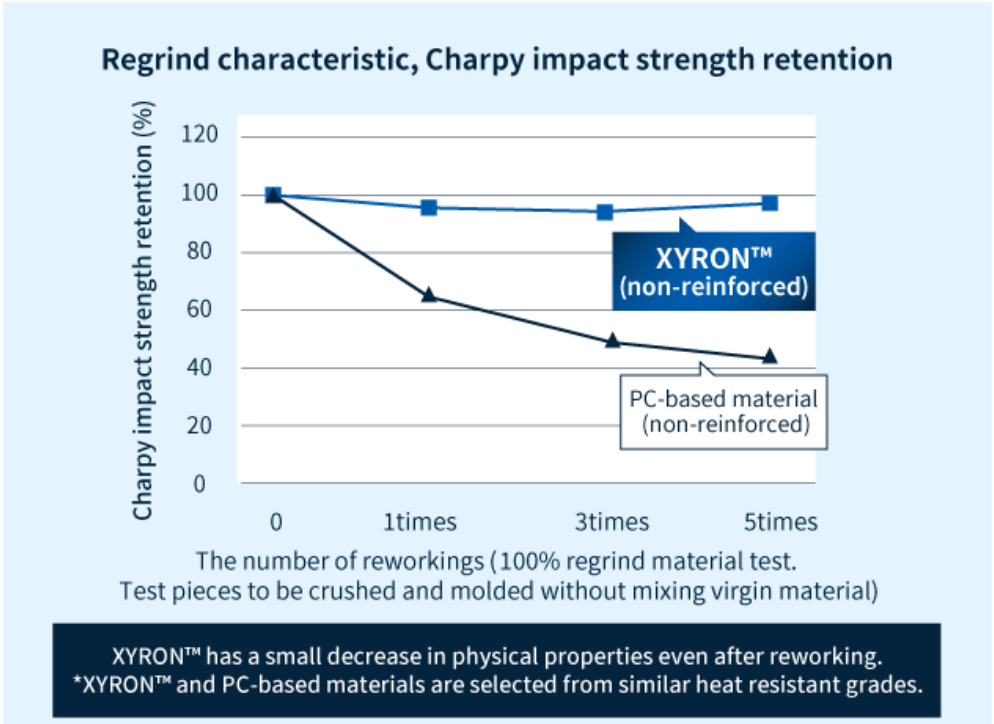
- PPE features low dielectric permittivity and a low dielectric loss tangent, ensuring minimal transmission losses and making these materials ideal for use in information and communication technologies.

Wide Range of Dielectric Properties of Modified PPE Resin XYRON™



- Modified PPE resins combine the low dielectric permittivity of PPE with the advantages of Asahi Kasei's compound technology to support a wide range of dielectric permittivity needs.

8 Excellent reworkability*

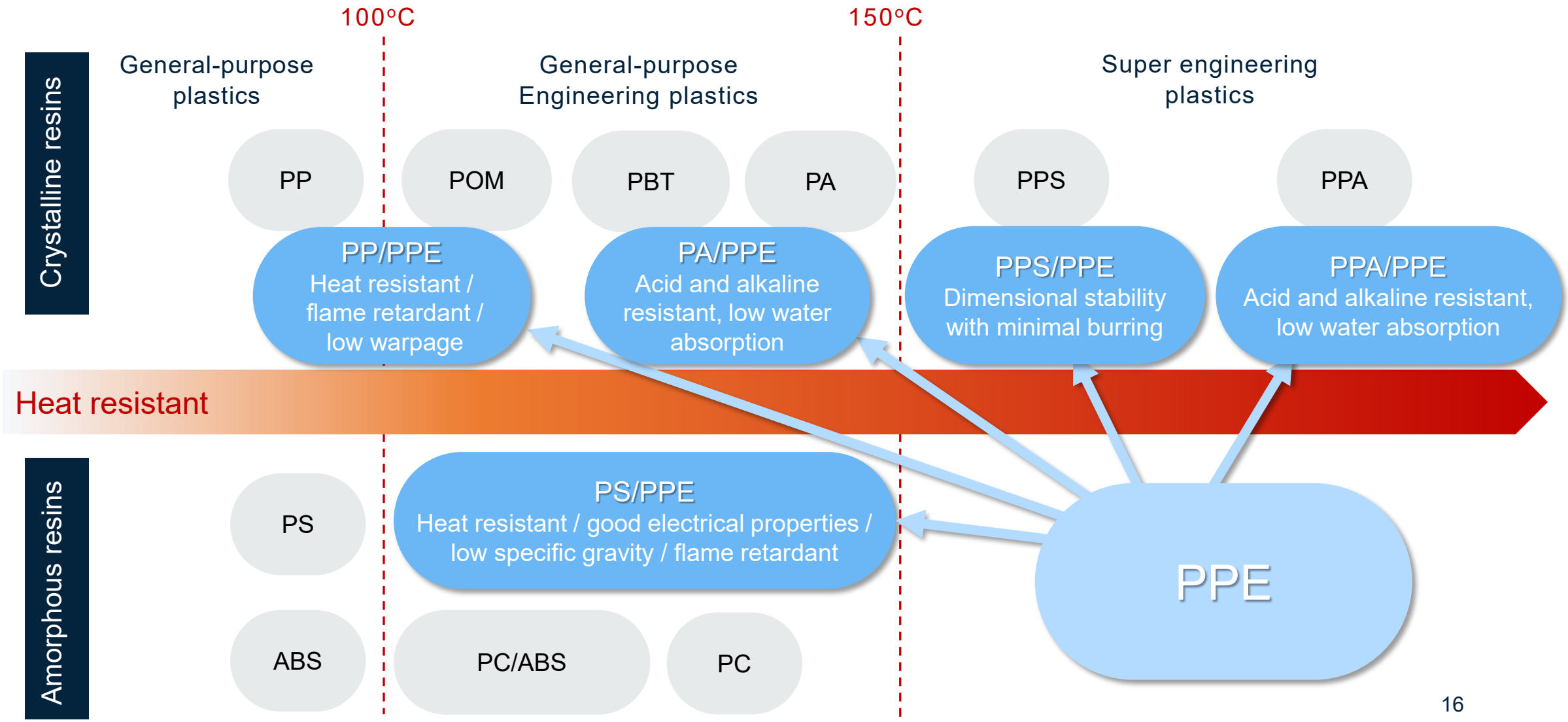


- The excellent heat resistance and hydrolysis resistance of XYRON™ modified PPE resins ensure that these products exhibit minimal variation in physical properties upon recycling and regrinding, making these materials easy to reuse.

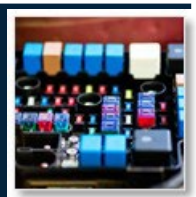
*excellent reworkability: the ability to be reworked or regrinded by using sprues, runners and so on, with good retention of mechanical properties.

Reasons for choosing XYRON™

Wide lineup of modified PPE resin XYRON™



Product grades

PPE/PS alloys		Heat resistance / Dimensional stability / Electrical properties / Flame resistance (non-halogen) / Resistance to hot water; acid/alkali resistance
PP/PPE alloys		Oil resistance; chemical resistance / Dimensional precision / Creep resistance / Gas-barrier properties / Resistance to copper contamination
PA/PPE alloys		Heat resistance / Low water absorption (compared to isolated PA resins) / Impact resistance / Oil resistance; chemical resistance
PPS/PPE alloys		Heat resistance / Dimensional stability and precision / Minimal burring / Flame resistance (UL94 V-0 or V-1)
PPA/PPE alloys		High heat resistance, high stiffness / Chemical resistance / Low specific gravity / Low water absorption / Dimensional stability

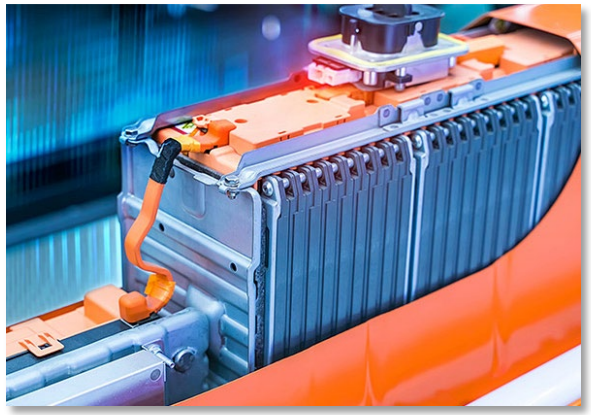
Application Cases

Asia's No. 1 manufacturer* of modified PPE resins

*Source: Fuji Keizai's 2023 Engineering Plastics Market Outlook and Global Strategies

Relay block / junction box
High heat resistance / High toughness

Head-up displays
Dimensional stability at high temperatures

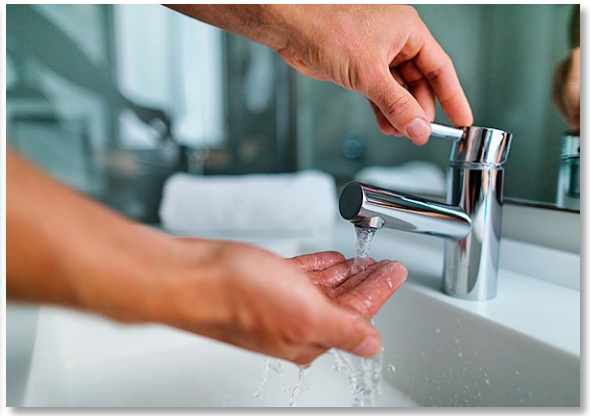


Inter-cell spacer
Creep characteristic /
Non-halogenated flame retardancy

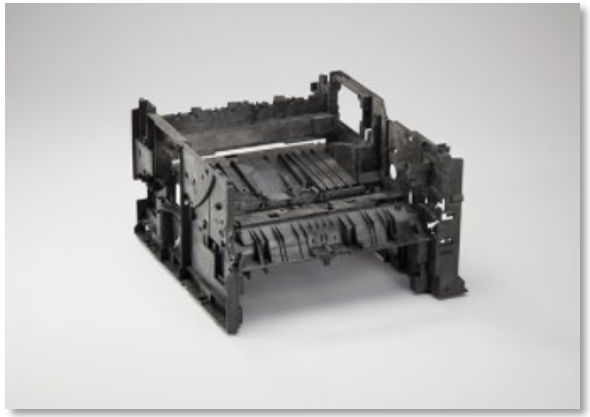
Bus bar cover
Thin-wall moldability / Insulation

Solar cell connecter
Tracking resistance

Smartphone chassis
Low dielectric constant



Water mixing tap
Excellent heat resistance /
Hydrolysis resistance

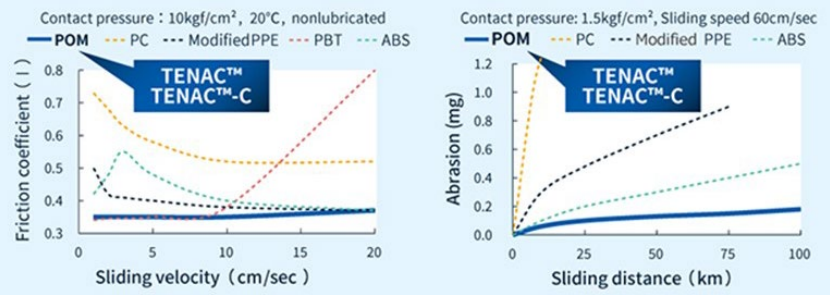


Printer mechanism parts
Ultra-low warpage /
High dimensional stability

Polyacetal Resin TENAC™

Key features of TENAC ™

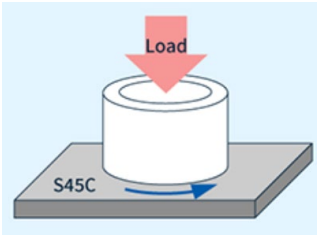
1 Sliding properties



Test machine : Thrust friction tester

■Measurement of friction coefficient :
A disc-shaped sample is rotated atop a slab or similar sample mount and the change in loading, and the rotational torque, are measured.

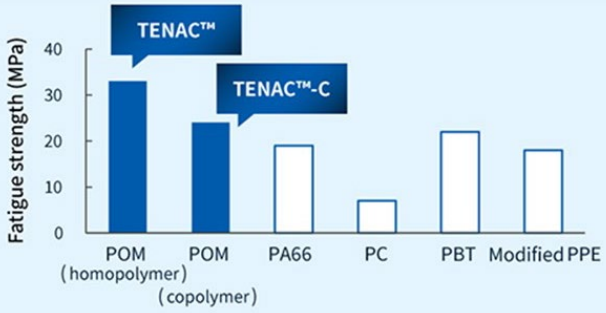
■Measurement of sliding wear properties :
Tests are conducted for a fixed period of time and the extent of abrasion associated with the induced friction is measured.



- POM resins have good sliding properties due to their self-lubricating nature, and also feature excellent wear and friction resistance.

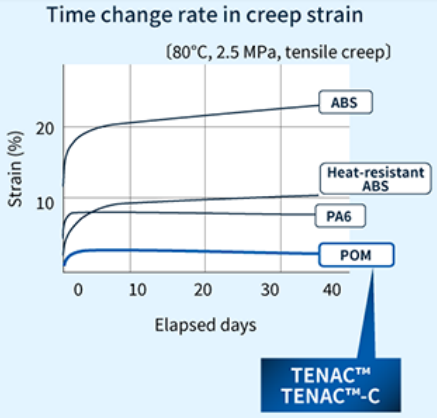
2 Fatigue behavior

Vibration fatigue test
Test method : ASTM D671B
Repetition rate : Under room temperature and frequency 30 Hz,
Stress compared upon breakdown after 10^6 repetitions



- POM resins offer the greatest room-temperature durability of all non-reinforced engineering plastics.

3 Creep resistance



Problems associated with creep phenomena

	Examples
Distortion	Expanded gaps between components
	Slippage in moving parts or causing strange noise
Slack	Loose screws
	Leakage from sealants
Breakdown	Breakdown or cracks in products
	Components falling off products

The excellent creep resistance of TENAC™/TENAC™-C resins avoid problems caused by creep phenomena.

4 Resistance to oil and organic solvents

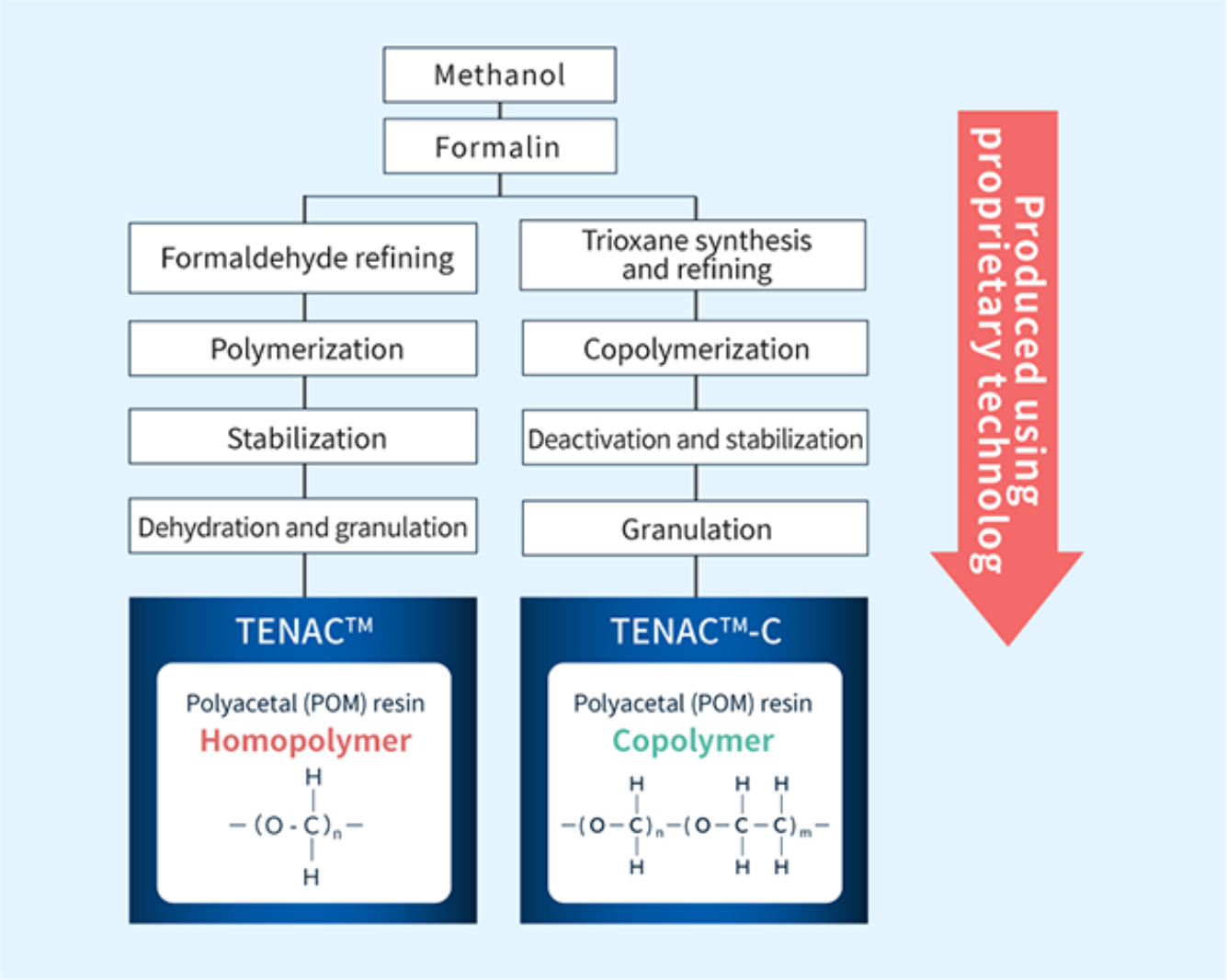
		POM homopolymer (TENAC™)	POM copolymer (TENAC™-C)
Oil resistance		++	++
Organic solvents resistance		++	++
Hot water resistance		--	+
Acid resistance	Weak acid	-	-
	Strong acid	--	--
Alkaline resistance	Weak alkali	-	+
	Strong alkali	--	+

Definitions of symbols in table ++ : Non corrosive + : Almost non corrosive - : Corrosive depending on conditions -- : Corrosive

Key features of TENAC ™

The world‘s only manufacturer* producing both homopolymer and copolymer POM resins by our own proprietary technology

*Source: Fuji Keizai's 2023 Engineering Plastics Market Outlook and Global Strategies



Product grades

High-durability 	Durability / Creep resistance / Resistance to metal abrasion / High viscosity
Low-VOC 	Low emission of volatile organic compounds (VOCs) / Weather resistance / Metallic tint (some grades)
Weather-resistant 	Resistant to ultraviolet radiation (compared to standard POM resins)
High-cycle 	Reduced molding time / Low warping / Dimensional precision
Lubricated 	Low friction coefficient / Low wear / Grade lineup suitable for sliding mating material
Filler-reinforced 	High elastic modulus / High strength / High stiffness
Soft 	Low elastic modulus / Intermediate viscosity
Electrically conducting 	Low electrical resistance / Good electrical conductivity / Prevention of static charge
HC (Homo-like Copolymer) 	High strength (compared to standard copolymers) / Chemical resistance (compared to standard homopolymers) / Resistance to thermal aging / Resistance to hot water

Application Cases

Fuel-pump modules
Excellent fuel resistant property

Seat-belt press buttons
Low VOC / Impact strength

Through anchors
UV resistance / Excellent impact strength

Printer gear
Good sliding properties

Conductive bearing
Excellent conductivity / Sliding properties

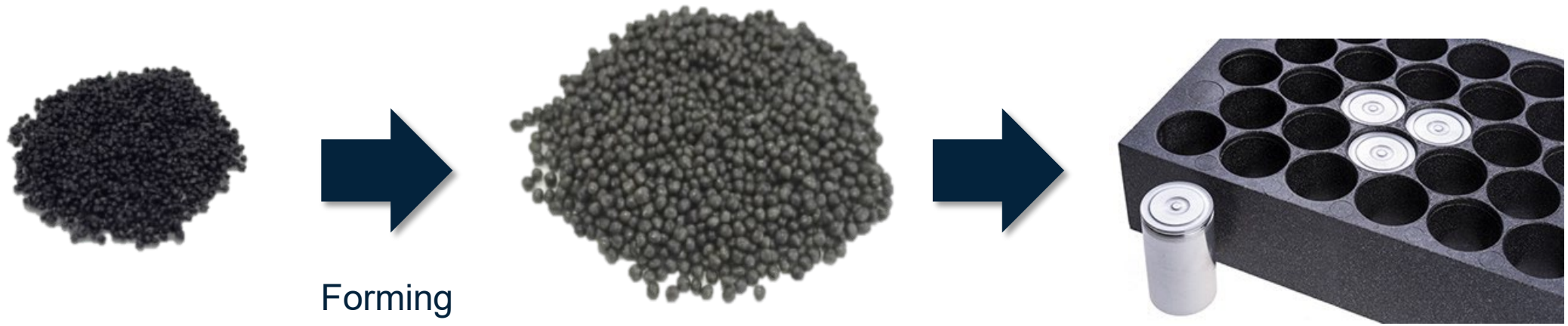
Infusion pump guide
High load Sliding properties

PIM : Powder Injection Molding
Super high flowability

m-PPE Foamed Beads SunForce™

Modified PPE Foamed Beads SunForce™

SunForce™ beaded foam, a product of Asahi Kasei's own plastic development and foaming processing technology.



1 Flame retardancy

- Under UL's flame retardance standard UL-94 for plastics and components, SunForce™ is certified V-0, which is a very high-level flame retardant.

2 Thermal resistance

The raw material of SunForce™ is an engineering plastic with superior heat resistance compared to other plastics,

3 Thermal insulation

- It has a low thermal conductivity compared to other materials and is a high-level heat insulator.

4 Formability

- While SunForce™ is a foam, it is also a material usable in components with thin ribs or for thin chassis.

5 Dimensional precision

- The dimensional change at the time of fabrication is also very small, and molding at a level similar to ordinary injection molded products is possible.

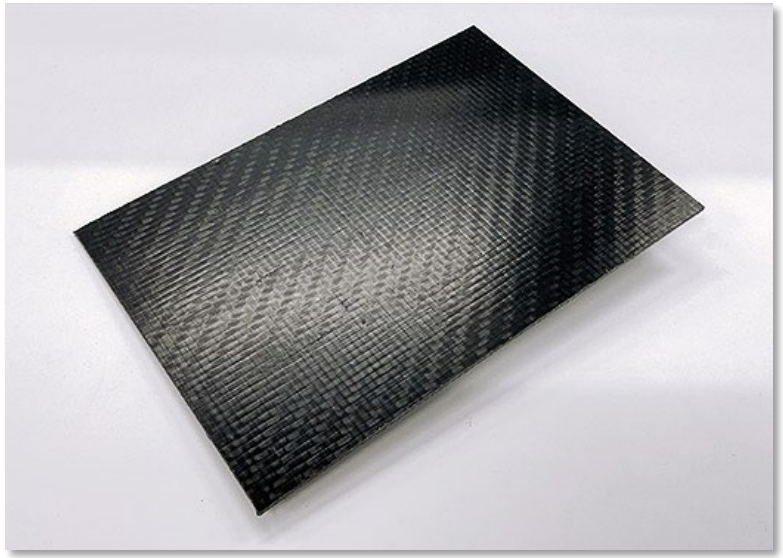
6 Light weight

- The large number of bubbles ensures that it is very light in comparison with the original material.

LENCEN™（c-GFRTP）

LENCEN™（c-GFRTP）

LENCEN™ (c-GFRTP) is a composite material formed by impregnating glass fiber textiles with polyamide resin, then solidifying to yield a sheet-shaped product.



Classification	Material	Item	Unit	Thermoplastic resin (FRTP)			Metal	
				PA66 resin				
				Continuous glass fiber(Vf47%)		Short glass fiber	Hi-ten steel. SS400	Aluminum alloy A5052
				Developed material	Conventional material	14G50		
Material	Specific gravity		°C	1.8	1.8	1.6	7.8	2.7
	Tensile strength		MPa	470	380	237	490	250
	Young's modulus		GPa	24	20	16	200	80
	Charpy impact strength (with notch)		kJ/kg @120mm	136	96	14	-	-
	Shock absorption (High-speed surface impact test)		kJ/kg @120mm	41.2	34.2	2	9.1	2.6

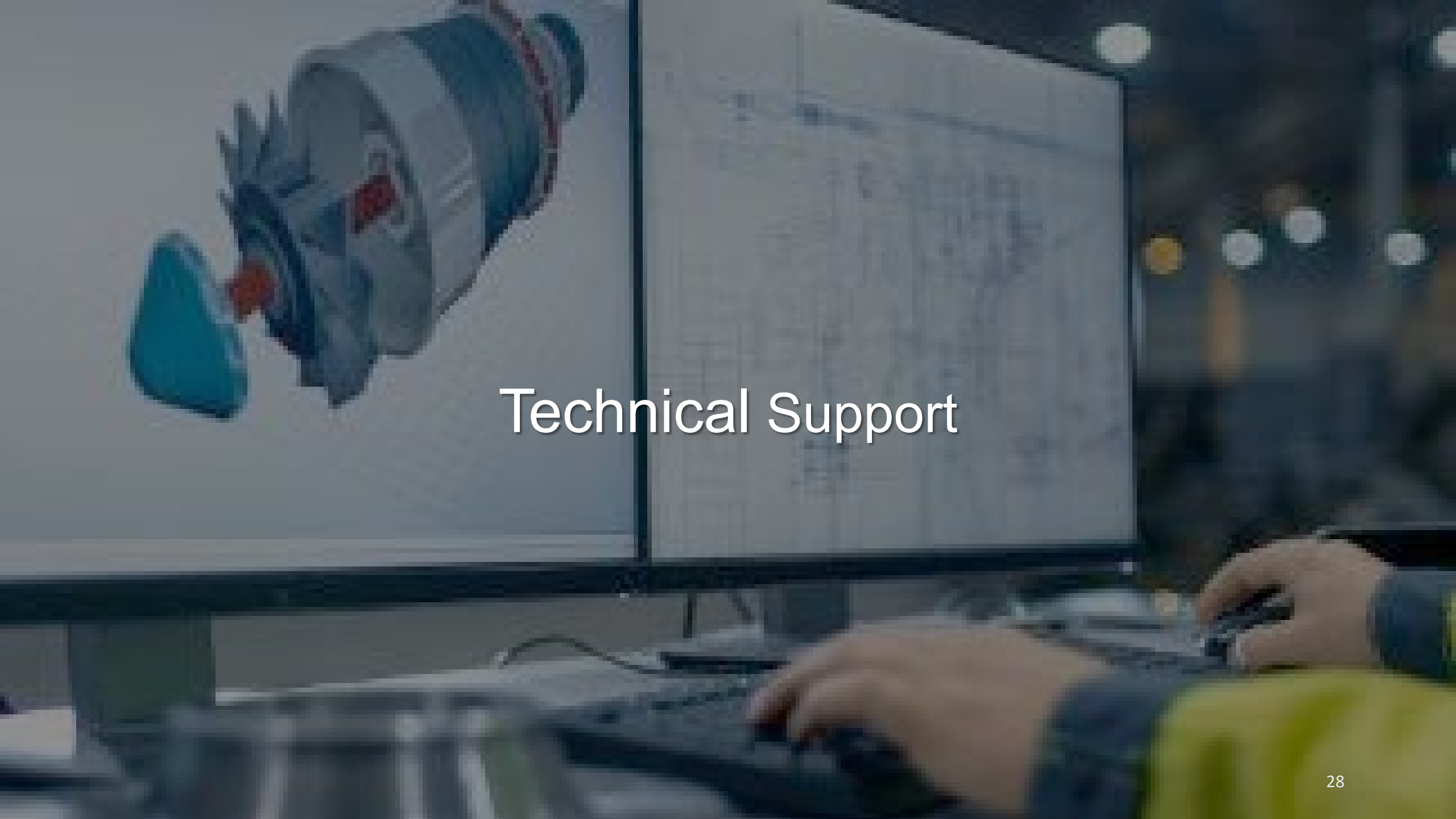
1 Light weight

2 High strength

3 High stiffness

4 Impact resistance

We intend to propose this material as a material that can provide crash safety and light weight effects because it has tensile strength and impact properties equal to or greater than those of metals, and can also contribute to improved reliability and fuel efficiency.



Technical Support

Technical Support

- **Resin Product Development Support Using CAE**
- Structural Design
- Simulation of Injection Molding
- Topology Optimization
- Process Support

We use resin CAE techniques to propose high-performance plastics product design with short lead times and low costs.

- Hundreds of cases in the past, mainly for automotive parts
- CAE Analysis Center opened in Vietnam in June 2016 to strengthen development using resin CAE analysis in Japan, Asia, US, and Europe
- Accelerate development of new products using Asahi Kasei resins by presenting design proposals based on optimization analysis and supporting mold design with flow and warpage analysis

Case study：**Topology optimization for brake pedal bracket**
(2018 Enlighten Award winning technology)

Steel model
406 g

Topology Optimization

LEONA™ 14G33
67.5 g

→ 83% reduction in weight

AsahiKASEI

Creating for Tomorrow

THE COMMITMENT OF THE ASAHI KASEI GROUP:

To do all that we can in every era to help the people of the world
make the most of life and attain fulfillment in living.
Since our founding, we have always been deeply committed
to contributing to the development of society,
boldly anticipating the emergence of new needs.
This is what we mean by “Creating for Tomorrow.”