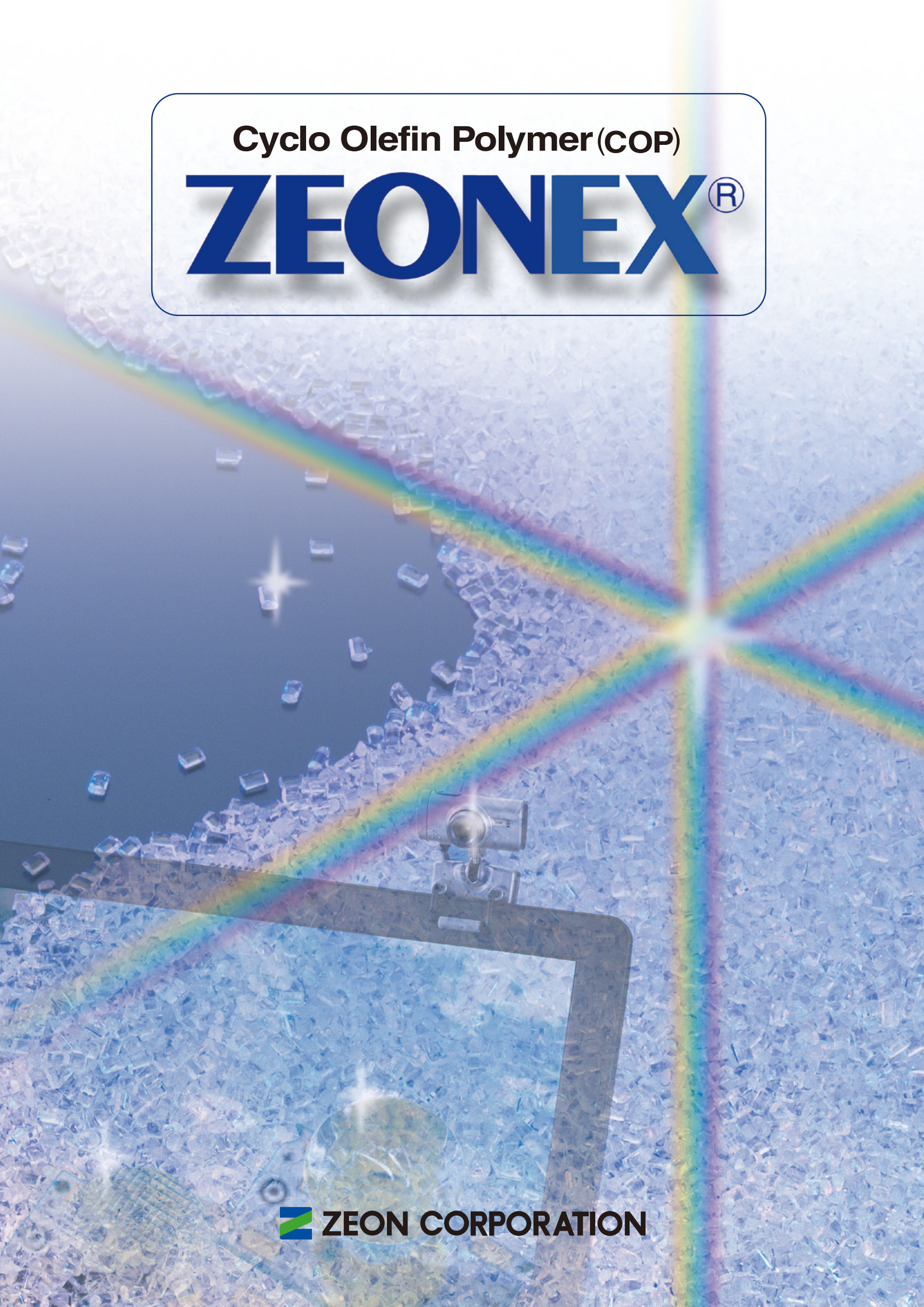
Cyclo Olefin Polymer (COP)

ZEONEX®



ZEON CORPORATION

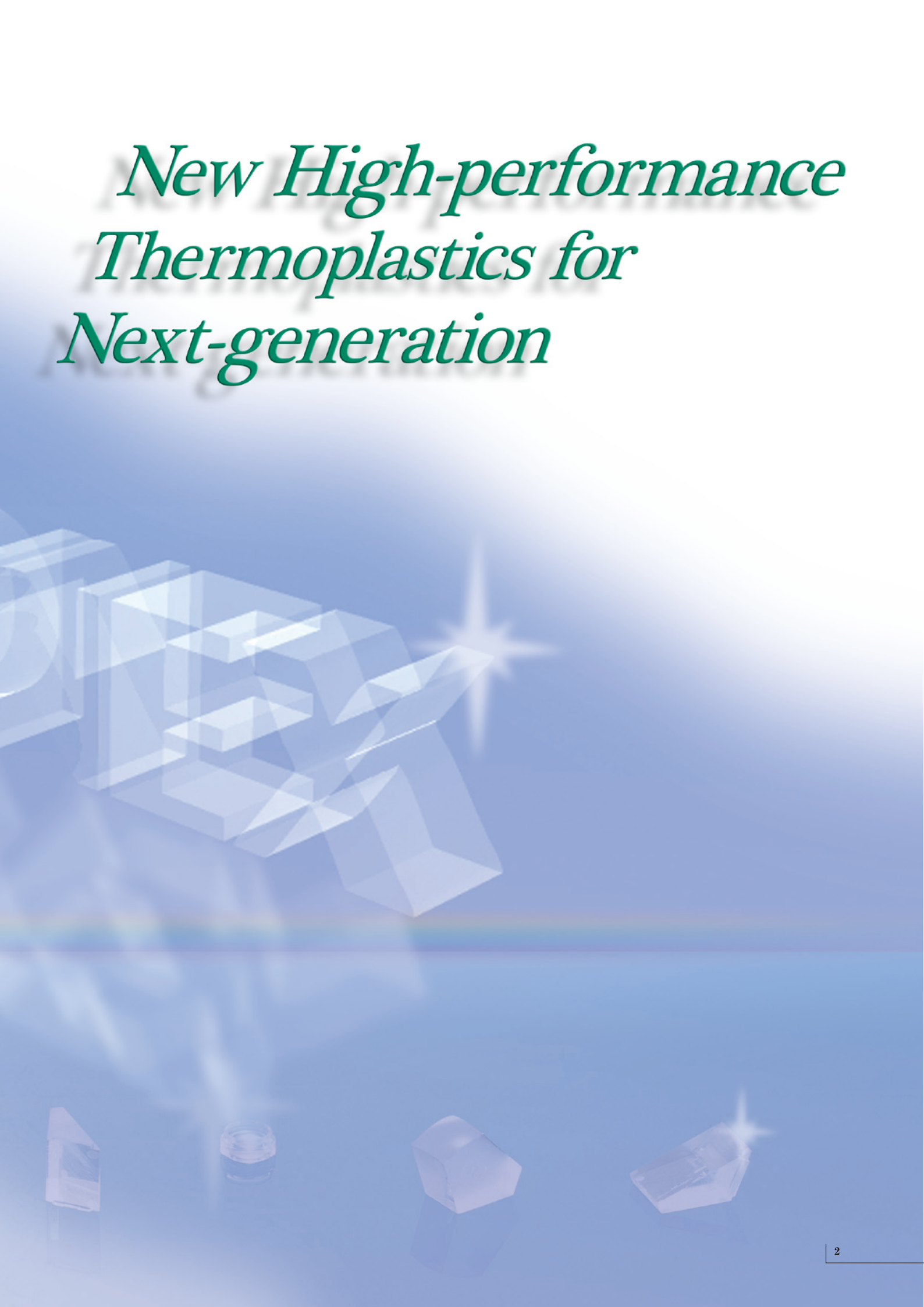
ZEONEX®

For optics, electronics, and medical applications

Another industry-leading development from ZEON CORPORATION

ZEONEX® — Cyclo Olefin Polymer (COP) offers excellent optical properties for creating optical parts for cameras and laser beam printers.
ZEONEX's high purity is suitable for a wide range of medical packaging products, while its low dielectric constant and loss tangents are appropriate for electrical insulation applications.

New High-performance Thermoplastics for Next-generation



Applications

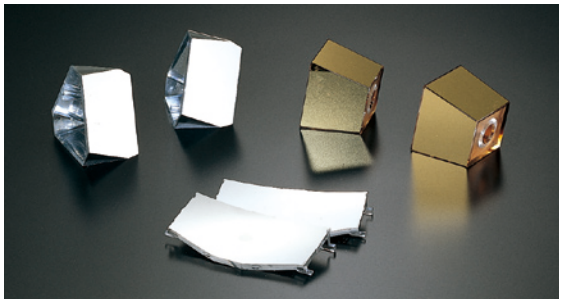
ZEONEX® Applications

Digital camera lenses, prisms and Mobile phone camera lenses

ZEONEX has earned high marks for low moisture absorption, good transparency, and high precision molding ability.

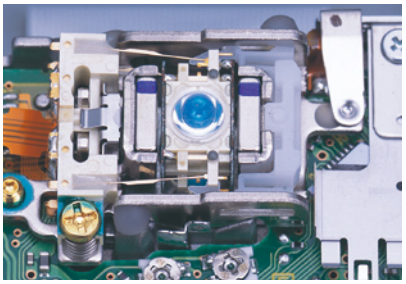
Mirrors

ZEONEX's low moisture absorption, good dimensional stability, and high-precision molding are perfectly fit for mirrors.



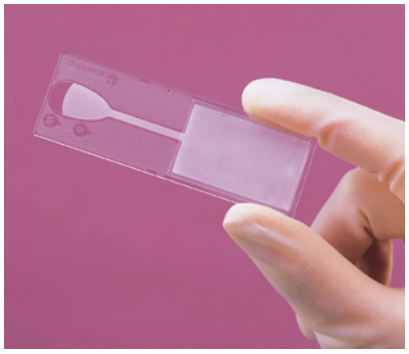
Pickup lenses, LBP Fθ lenses, and projector lenses

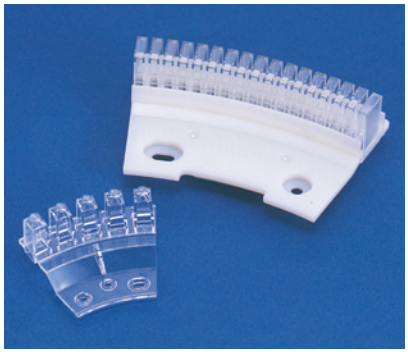
For pickup lenses and LBP Fθ lenses, ZEONEX's low birefringence, low moisture absorption, and high-precision molding ability will bring high values.

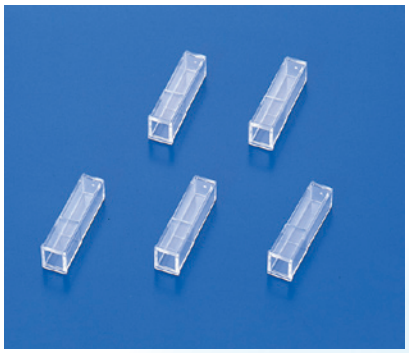


Other applications

ZEONEX is also favored in electronics, medical packaging and optronics fields, with its outstanding heat resistance, low impurity chemical resistance and electric properties.







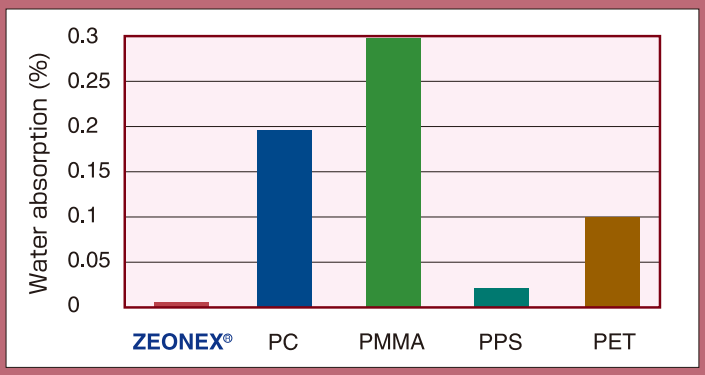
●Disclaimer : All pictures in this page are example use only. For actual use, please see PL Notes (page14) and ask ZEON.

Features

ZEONEX® basic properties

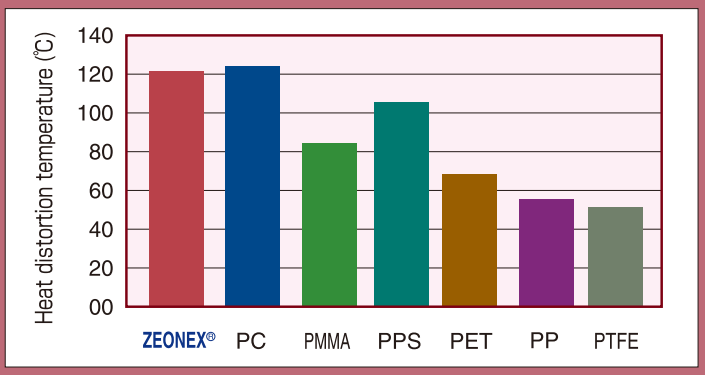
Low water absorption

Water absorption is less than 0.01%



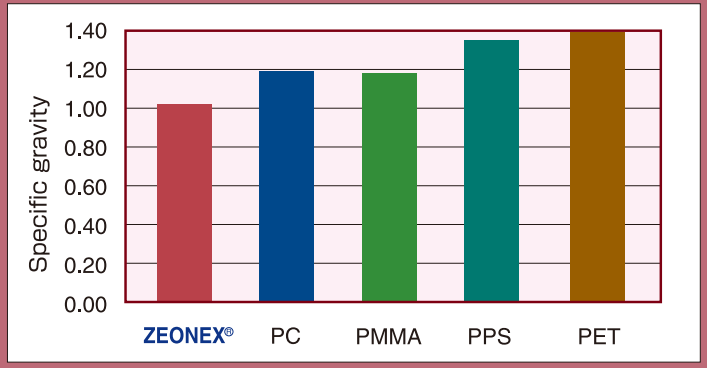
High heat resistance

The heat distortion temperature is above 100°C



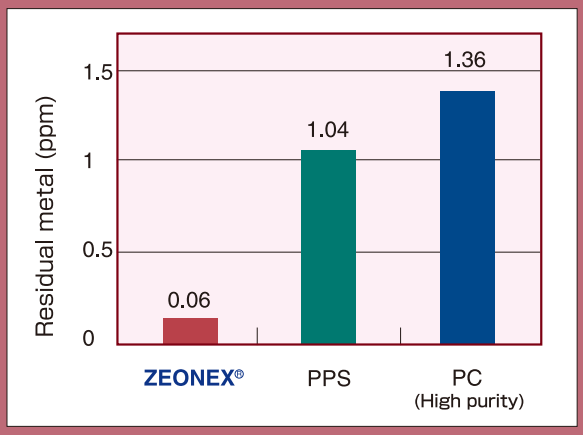
Low specific gravity

Specific gravity is approximately 1, which is 20% lighter than general plastics.



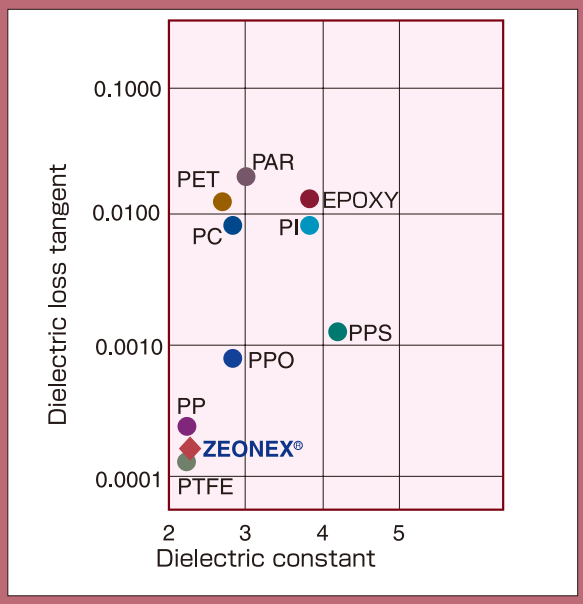
Low content of impurities

Very low impurities



Low dielectric constant and low dielectric loss tangent

Thermoplastic resin with the lowest dielectric constant and lowest dielectric loss tangent



Chemical resistance

Excellent resistance to acid and alkali.

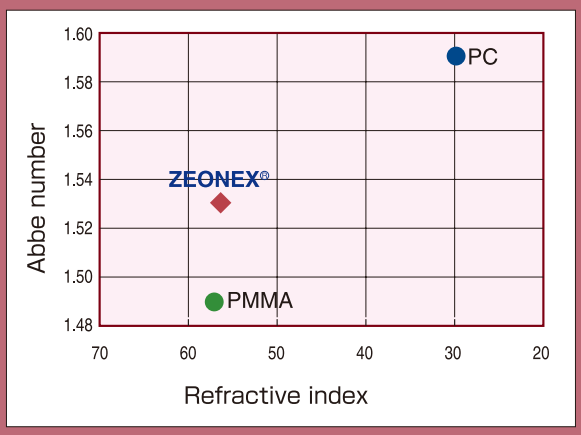
Transparency

High transparency and Low birefringence.

Precision molding

Ideal for high-precision molded products and blow molding

Refractive index

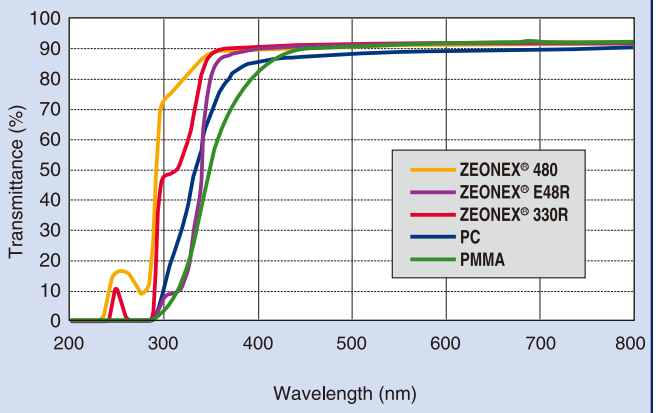


Properties

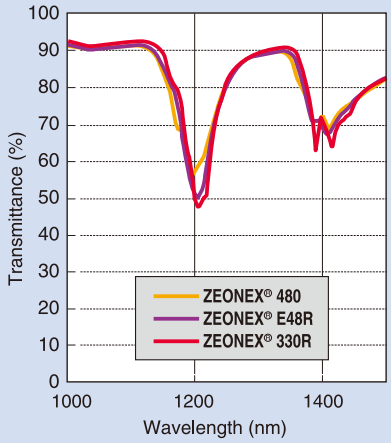
ZEONEX® characteristic properties

Light transmittance

Light transmittance



NIR wavelength



Dependence of refractive index on temperature and wavelength

Thickness: 3 mm

480R		Wavelength (nm)						Abbe number
		435.835(g)	486.133(F)	546.075(e)	587.562(d)	656.273(C)	785.1(L.D780)	νd
Temperature (°C)	0	1.5396	1.5343	1.5300	1.5277	1.5250	—	56
	25	1.5369	1.5317	1.5273	1.5251	1.5224	—	56
	40	1.5352	1.5299	1.5257	1.5234	1.5207	1.5174	57
	60	1.5329	1.5276	1.5234	1.5211	1.5184	1.5152	57
	80	1.5308	1.5253	1.5214	1.5189	1.5164	1.5132	58

E48R		Wavelength (nm)						Abbe number
		435.835(g)	486.133(F)	546.075(e)	587.562(d)	656.273(C)	785.1(L.D780)	νd
Temperature (°C)	0	1.5456	1.5402	1.5357	1.5334	1.5306	—	56
	25	1.5432	1.5378	1.5334	1.5311	1.5283	—	56
	40	1.5417	1.5363	1.5319	1.5296	1.5268	1.5234	56
	60	1.5396	1.5342	1.5299	1.5275	1.5247	1.5214	56
	80	1.5375	1.5320	1.5278	1.5254	1.5228	1.5195	57

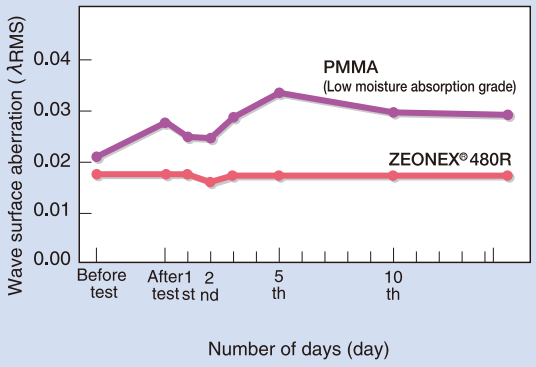
330R		Wavelength (nm)						Abbe number
		435.835(g)	486.133(F)	546.075(e)	587.562(d)	656.273(C)	785.1(L.D780)	νd
Temperature (°C)	0	1.5236	1.5185	1.5143	1.5121	1.5094	—	56
	25	1.5208	1.5157	1.5116	1.5094	1.5067	—	56
	40	1.5192	1.5141	1.5101	1.5079	1.5052	1.5019	57
	60	1.5169	1.5118	1.5078	1.5056	1.5030	1.4997	57
	80	1.5145	1.5094	1.5053	1.5031	1.5005	1.4973	56

※Carl Zeiss Jena Refractive index detector PR-2 model (0 degrees C and 25 degrees C)
Kalnew Digital Precise Refractive index detector KPR-200(40 degrees C to 80 degrees C)
Data represents experimental results and does not guarantee specific performance levels under actual usage.

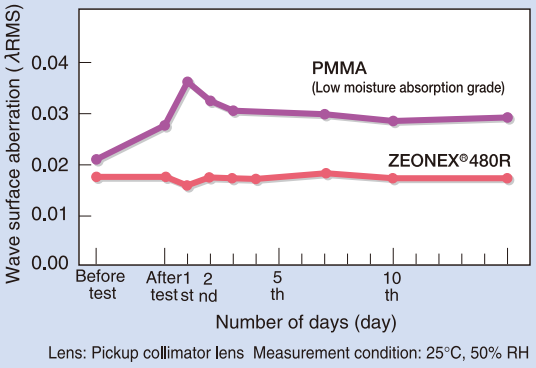
Environmental resistance

Environmental resistance of ZEONEX® lenses

1. High temperature and high humidity—maintains at 60°C, 90% RH, for 168 hours.

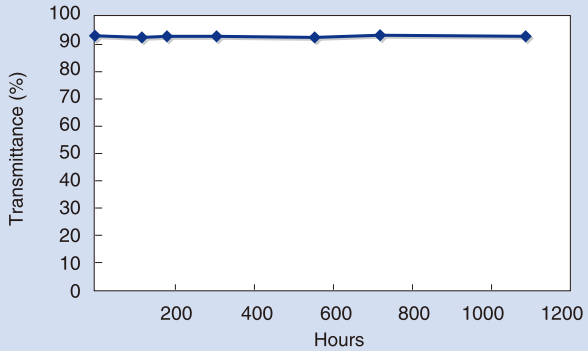


2. Heat cycle test—10 cycles at 85°C for 30 minutes to 40°C for 30 minutes



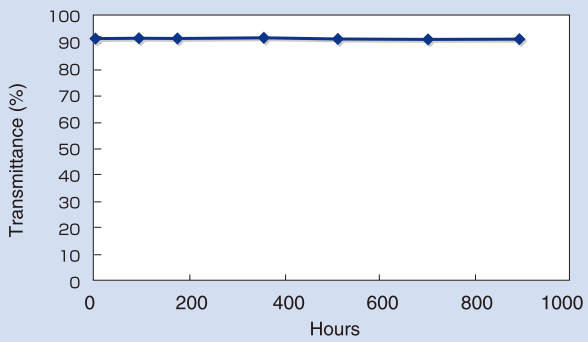
Lens: Pickup collimator lens Measurement condition: 25°C, 50% RH

Heat resistance test



Measurement condition : 3㎜t Injection molding plate
80℃ Oven

Light resistance test



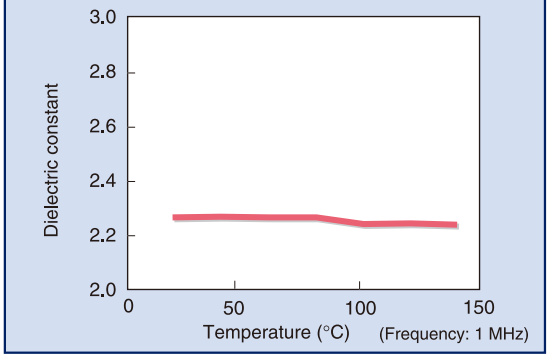
Measurement condition : 3㎜t Injection Moldingplate
Black panel temperature63℃
Light corbon mark／fede mater

Properties

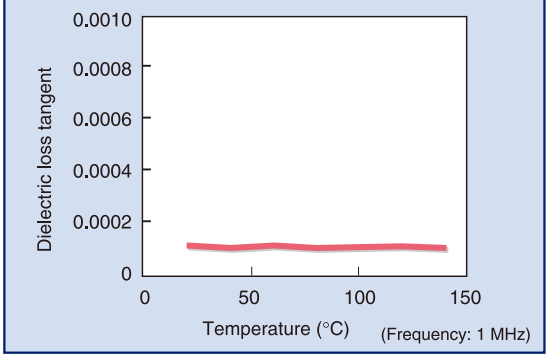
ZEONEX® characteristic properties

Electric properties

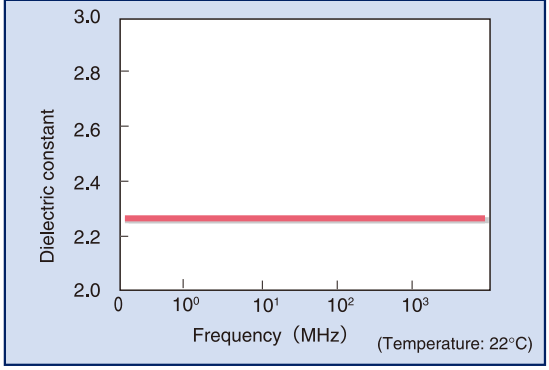
Dielectric constant vs. temperature



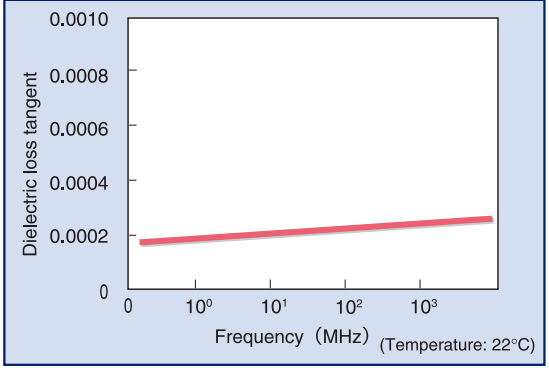
Dielectric loss tangent vs. temperature



Dielectric constant vs. frequency



Dielectric loss tangent vs. frequency



Comparison of ZEONEX® and other resins

Properties	Unit	Measurement methods	Requirements	ZEONEX 480R	PC optical grade	PC	PMMA	PTFE	PS (GP)	PP
Specific gravity	—	ASTM D792		1.01	1.2	1.2	1.17 ~1.2	2.14 ~2.2	1.04 ~1.05	0.90 ~0.91
Water absorption	%	ASTM D570		<0.01	0.2	0.15	0.3	<0.01	<0.1	<0.01
Light transmittance	%	ASTM D1003	Thickness: 3mm	92	89	89	93	—	90	—
Refractive index	—	ASTM D542	n_d^{25}	1.525	1.59	1.59	1.49	—	1.59	1.49
Heat distortion temperature	℃	ASTM D648	18.6kgf/cm² No annealing	123	121	123 ~132	74 ~99	55	90 ~104	49~60
Linear expansion coefficient	cm/cm℃	ASTM D696		7×10^{-5}	7×10^{-5}	7×10^{-5}	$5\sim9\times10^{-5}$	10×10^{-5}	$6\sim8\times10^{-5}$	11×10^{-5}
Molding shrinkage	%	ASTM D955		0.5~0.7	0.5~0.7	0.5~0.7	0.3~0.7	—	0.3~0.7	1.6~1.9
Flexural modulus	kgf/cm²	ASTM D790		21000	21000	24000	30000		30000	12000 ~18000
Flexural strength	kgf/cm²	ASTM D790		960	920	1000	1100	3500 ~6300	800	400
Tensile modulus	kgf/cm²	ASTM D638		22000	21000	22000	23000 ~33000	4000 ~5600	32000 ~34000	12000 ~16000
Tensile strength	kgf/cm²	ASTM D638		600	630	670	490 ~770	140 ~350	500 ~580	320 ~420
Tensile elongation	%	ASTM D638		40	90	110	2~10	200 ~400	2.0~3.6	100 ~600
Izod impact strength	kgf·cm/cm	ASTM D256	3.2mm Notched	2.4	6	75~100	1.6~3.3	16.3	2.2~2.4	2.2 ~5.4
Pencil hardness	—	JIS K5401		H	B	B	3H	—	—	—
Volume resistivity	Ω cm	ASTMD257		$>10^{16}$	$>10^{16}$	$>10^{16}$	$>10^{15}$	$>10^{16}$	$>10^{16}$	$>10^{16}$
Dielectric breakdown strength	KV/mm	ASTM D149		40	30	18~22	20	9~12	22	30~32
Dielectric constant	—	ASTMD150	1MHZ	2.3	3.0	3.0	2.6	2.1	2.5	2.3
Dielectric loss tangent	—	ASTMD150	1MHZ	0.0002	0.009	0.01	0.02	0.0002	0.0005	0.0003

ZEONEX® characteristic properties

Chemical resistance

Test results

		330R	480R	E48R
Alcohol	Methanol	○	○	○
	Ethanol	△	○	○
	IPA (isopropyl alcohol)	×	○	○
Ketone	Acetone	×	○	○
	MEK (methyl ethyl ketone)	×	○	△
	Cyclohexanone	×	×	×
	MIBK (methylisobutyl ketone)	×	×	×
Ether	THF (tetrahydrofuran)	× Dissolve	×	× White
Aromatic	Xylene	× Dissolve	× Dissolve	× Swollen
Hydrocarbon	n-Hexane	× Dissolve	× Swollen	× White
Acid	Concentrated hydrochloric acid	○	○	○
	Concentrated sulfuric acid	○	○	○
	Nitric acid	○	○	○
Alkali	Caustic soda (50%)	○	○	○
	Aqueous ammonia (10%)	○	○	○
Foods	Salad oil	×	×	×
	Margarine	×	×	×
	Lemon juice	○	○	○
Other	Limonene	× Dissolve	× Dissolve	× Dissolve

Marginal stress
140kgf/cm²or more ＝○（usable）
100～140kgf/cm² ＝△（exercise caution in use）
100kgf/cm²or less ＝×（unusable）

Impurities

Concentration of impurities in ZEONEX®

Impurity	Detectable limit (ppm)	Concentration
Ca^{2+}	0.02	Less than detectable limit
Na^{+}	0.02	
Cl^{-}	0.2	
SO_4^{2-}	1.1	
SO_3^{-}	2.7	
PO_4^{2-}	3.3	

ZEONEX® basic molding properties

Predrying

Air (oxygen) dissolved in ZEONEX® pellets can cause discoloration, carbide and the occurrence of voids. ZEONEX® should be dried (heated) to remove air in the pellets for 4 to 10 hours at the temperatures recommended for each product number indicated below before molding. Drying for too long a period may cause heat deterioration, and possibly discoloration in the molded articles.

Product name	ZEONEX® 480R・480	ZEONEX® E48R	ZEONEX® 330R	ZEONEX® RS420
Recommended temperature	100～110℃	100～110℃	90～100℃	100～110℃

Standard injection molding conditions

Molding conditions vary depending upon factors including the molding machine and the tool. Please refer to the list of recommended temperatures below for each product number as well as glass transition point (Tg) and MI, and set molding conditions accordingly.

Product name	ZEONEX® 480R・480	ZEONEX® E48R	ZEONEX® 330R	ZEONEX® RS420
Cylinder temperature	260～290℃	260～290℃	240～260℃	250～300℃
Mold temperature	90～135℃	90～135℃	90～120℃	60～120℃
Injection pressure	500～1500kgf/cm²			
Holding pressure	500～1800kgf/cm²			
Back pressure	50～100kgf/cm²			
Injection speed	30～80cm³/sec			
Screw speed	20～40rpm			

Nitrogen sealing

(1) Necessity of Nitrogen Sealing

ZEONEX® is stable even at 280 °C for 30 hours when oxygen is not present, so defects such as carbonization, burning and discoloration do not occur in products. Since these problems will arise in the presence of oxygen, nitrogen sealing should be used to prevent oxygen from entering into the injection molding process. Nitrogen sealing is very effective for molding optical parts, preventing discoloration and the entrance of contamination caused by resin decomposition.

(2) Nitrogen Sealing Method

Fig.1 shows the method for nitrogen sealing, and Fig.2 shows a simplified nitrogen sealing method.

(1) As shown below, feeding nitrogen to the lower part of the hopper prevents mixture with air. This is also effective when air is used for transport.

(2) Before increasing the cylinder temperature, nitrogen is introduced in order to purge air from the inside of the cylinder. After this, the resin can be poured.

(3) The flow rate of nitrogen depends on the capacity of the molding machine. For example, nitrogen flow rate 3 liters/minute (cylinder diameter: 15 to 30 mm;resin residence time: 5 to 30 minutes). Concentration of N2 should be 99% or higher, and a concentration of 99.9% or higher is recommended.

※When a nitrogen sealing is applied, carefully monitor the increase in nitrogen density in the molding room and be sure to provide periodical ventilation.

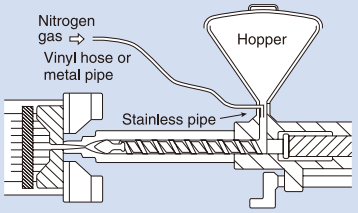


Fig.1 Nitrogen sealing method

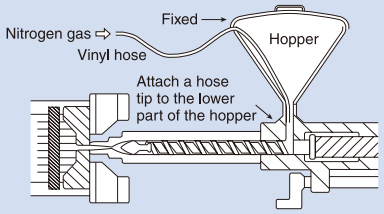


Fig.2 Simplified nitrogen sealing method

※For more details, please ask ZEON

ZEONEX® Grade List

Suitable ZEONEX®grade for your applications.

Properties	Unit	Measurement methods	Conditions	480	480R	E48R	330R	RS420
Specific gravity	—	ASTM D792	—	1.01	1.01	1.01	0.95	1.01
Water absorption	%	ASTM D570	—	＜0.01	＜0.01	＜0.01	＜0.01	＜0.01
Light transmittance	%	ASTM D1003	Thickness:3mm	92	92	92	92	White opaque
Refractive index	—	ASTM D542	—	1.525	1.525	1.531	1.509	—
Glass transition temperature	℃	JIS K7121	—	138	138	139	123	136 (DSC)
Heat distortion temperature	℃	ASTM D648	18.0MPa No aneal	123	123	122	103	110 (ISO75)
Linear expansion coefficient	cm/cm℃	ASTM E831	—	7×10^{-5}	7×10^{-5}	6×10^{-5}	7×10^{-5}	7×10^{-5}
M F R	g/10min	ISO 1133	280℃21.18N	20	21	25	—	8 (JIS K 6719)
			260℃21.18N	—	—	—	11	—
Flexural modulus	MPa	ISO178	—	2100	2100	2500	3100	1600
Flexural strength	MPa	ISO178	—	94	94	104	91	64
Tensile modulus	MPa	ISO527	—	2200	2200	2500	—	1700
Tensile strength	MPa	ISO527	—	59	59	71	45	45
Tensile elongation	%	ISO527	—	40	40	10	3	135
Izod impact strength	J/m	ASTM D256	3.2mm With Notch	24	24	21	13	510
Pencil hardness	—	JIS K5401	—	H	H	H	3H	B
Volume resistivity	Ωcm	IEC93	—	$>10^{16}$	$>10^{16}$	$>10^{16}$	$>10^{16}$	$>10^{16}$ (ASTM D257)
Dielectric breakdown strength	kV/mm	ASTM D149	short-time method,1mm	40	40	40	40	40
Dielectric constant	—	IEC250	1MHz	2.3	2.3	2.3	2.3	2.3 (ASTM D150)
Dielectric loss tangent	—	IEC250	1MHz	0.0002	0.0002	0.0002	0.0004	0.0002 (ASTM D150)
Flammability	—	UL standards	—	94HB	94HB	94HB	94HB	94HB
Major applications	—	—	—	Medical equipment and optical components	Lenses and optical components	Lenses and optical components	Lenses and optical components	Connector and antenna components

※Data represents experimental results and does not guarantee specifie performance levels under actual usage.

PL(Product Liability) Notes

1. Please observe the following precautions for the storage and use of the product and items molded from the product.

   (1) Keep away from fire, since ZEONEX® is combustible.
   (2) Avoid exposure to direct sunlight, which can discolor ZEONEX®.
   (3) Do not use or expose to temperatures over heat distortion temperature, since ZEONEX® may discolor, deform, or melt.
   (4) Improper molding conditions or use with a poorly designed mold may induce solvent cracking through residual stress.
   (5) Do not use for parts that are subject to continuing load (snap fit insert molded products, screw stops, etc.), since the material may crack.
   (6) Do not expose to the following solvents and liquids which may cause ZEONEX® to liquefy or swell.
   - Aromatic solvents such as benzene, toluene, etc.
   - Chlorinated hydrocarbon solvents, including dichloromethane, carbon tetrachloride, etc.
   - Vegetable and mineral oils and greases
   - Hydrocarbon solvents such as n-Hexane, cyclohexane and ligroin, etc.
   - Ethers such as diethylether, etc.
   - Ketones such as cyclohexanone, etc.
   - Prior to use test other materials and liquids containing long-chain alkyl groups in their structure prior to use.

   (7) Test ZEONEX® for chemical resistance prior to use.

2. Contact ZEON CORPORATION before utilizing ZEONEX® in medical care products, foods or toys.

3. Please refer to the Material Safety Data Sheet for specific details.

Related laws and standards

1. TSCA : TSCA Inventory
2. EINECS : EINECS Inventory

Other disclaimers and warnings

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