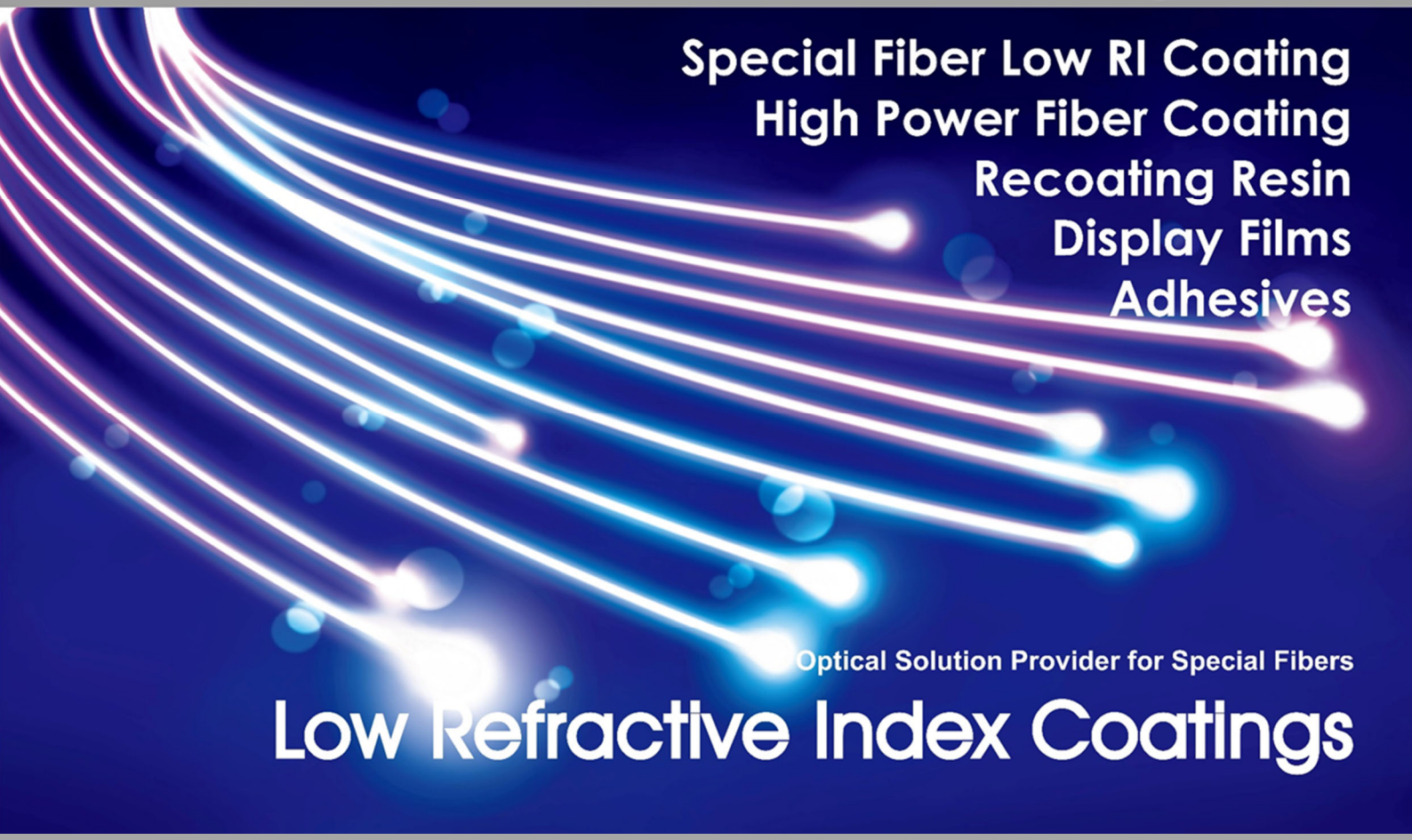
Luvantix ADM

UV Curable Low Refractive Index Coatings



Special Optical Fiber

Coating & Adhesives

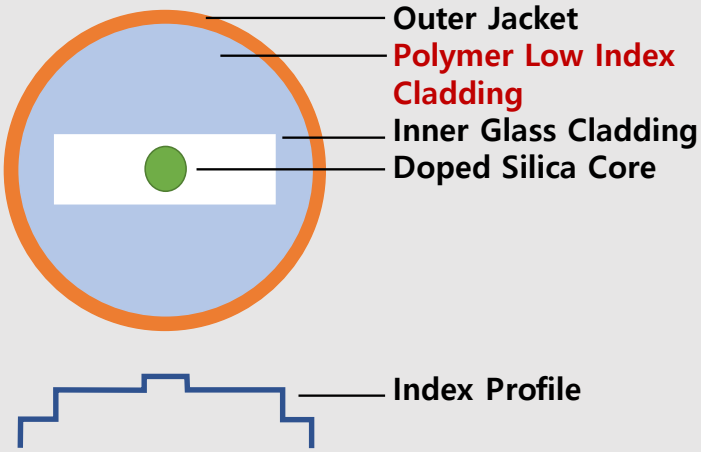
PRODUCT LIST

2020. 01.

Low Refractive Index Fiber Coating

▪ PC Series for Polymer Cladding

PC (Polymer Clad) series, have been tested and being used by major fiber optic industries for various applications including high power double clad optical fibers and bio-chemical sensing micro capillaries. Utilizing our Fluorinated acrylate polymer chemistry, PC series can provide unique UV curable polymer coatings with superb properties: refractive indies from 1.452 down to 1.340, more than 90% transmittance in the Near UV-Visible-Near IR range and excellent adhesion capability over silica surface.



LAP Series : The legendary products since 1997 optimized for the fiber drawing process

HA Series : The strongest adhesion among PC series with PFOA & PFOS free formulations

LD Series : Recoat coating tuned to both UV LED sources and conventional UV lamps

Product Code	PC-340HA	PC-350HA	PC-363HA	PC-370HA	PC-373HA
Viscosity (cPs)	4500	6200	6800	6200	6500
Liquid Refractive Index (589nm)	1.342	1.347	1.360	1.365	1.367
Cured Refractive Index (589nm)	1.344	1.352	1.362	1.375	1.376
Cured Refractive Index (852nm)	1.330	1.350	1.363	1.370	1.373
Numerical Aperture (NA)	0.58	0.53	0.50	0.48	0.47
Secant Modulus@ 2.5% (MPa)	14	15	44	87	106
Elongation at Break (%)	102	52	70	70	49
Glass Transition Tg (°C)	23℃	23℃	30℃	<70℃	<73℃
Decomposition 5% Td (°C)	<260°C	<260°C	<260°C	<260°C	<260°C
Thermal Expansion Coefficient (10^{-6}/K)	220	215	216	251	210
Thermal Conductivity (W/mk)	0.14	0.14	0.15	0.15	0.16

Product Code	PC-375HA	PC-398HA	PC-404HA	PC-414HA	PC-452HA
Viscosity (cPs)	5600	1982	4900	6300	5100
Liquid Refractive Index (589nm)	1.378	1.387	1.396	1.404	1.449
Cured Refractive Index (589nm)	1.391	1.400	1.406	1.416	1.465
Cured Refractive Index (852nm)	1.385	1.398	1.404	1.414	1.452
Numerical Aperture (NA)	0.44	0.40	0.37	0.33	0.05
Secant Modulus@ 2.5% (MPa)	244	285	348	245	874
Elongation at Break (%)	69	35	20	20	5
Glass Transition Tg (°C)	75℃	76℃	85℃	90℃	82℃
Decomposition 5% Td (°C)	<240°C	<220°C	<220°C	<220°C	<220°C
Thermal Expansion Coefficient (10^{-6}/K)	187	370	280	290	330
Thermal Conductivity (W/mk)	0.18	0.18	0.28	0.28	0.29

Low Refractive Index with -35°C Tg

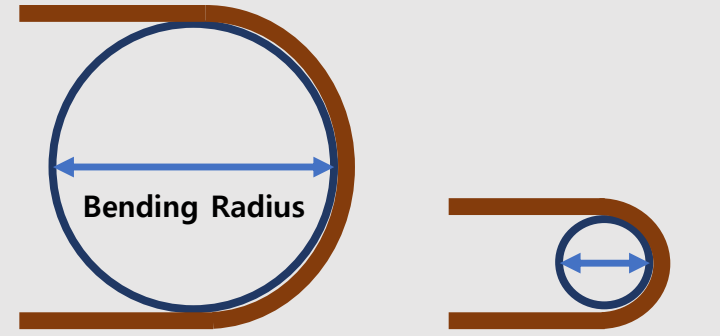
▪ Low Tg & Low Refractive Index Primary Coating

PC-LG Series is the world first low Tg low index UV curable polymer clad for fiber laser application. It has the lowest glass transition temperature Tg of -35°C with low refractive index of 1.350 for NA 0.53.

This low Tg low RI coating can be used as a primary coating of tele-communication fiber. It absorbs stresses from outside force or from secondary coatings, allowing tight bending radius.

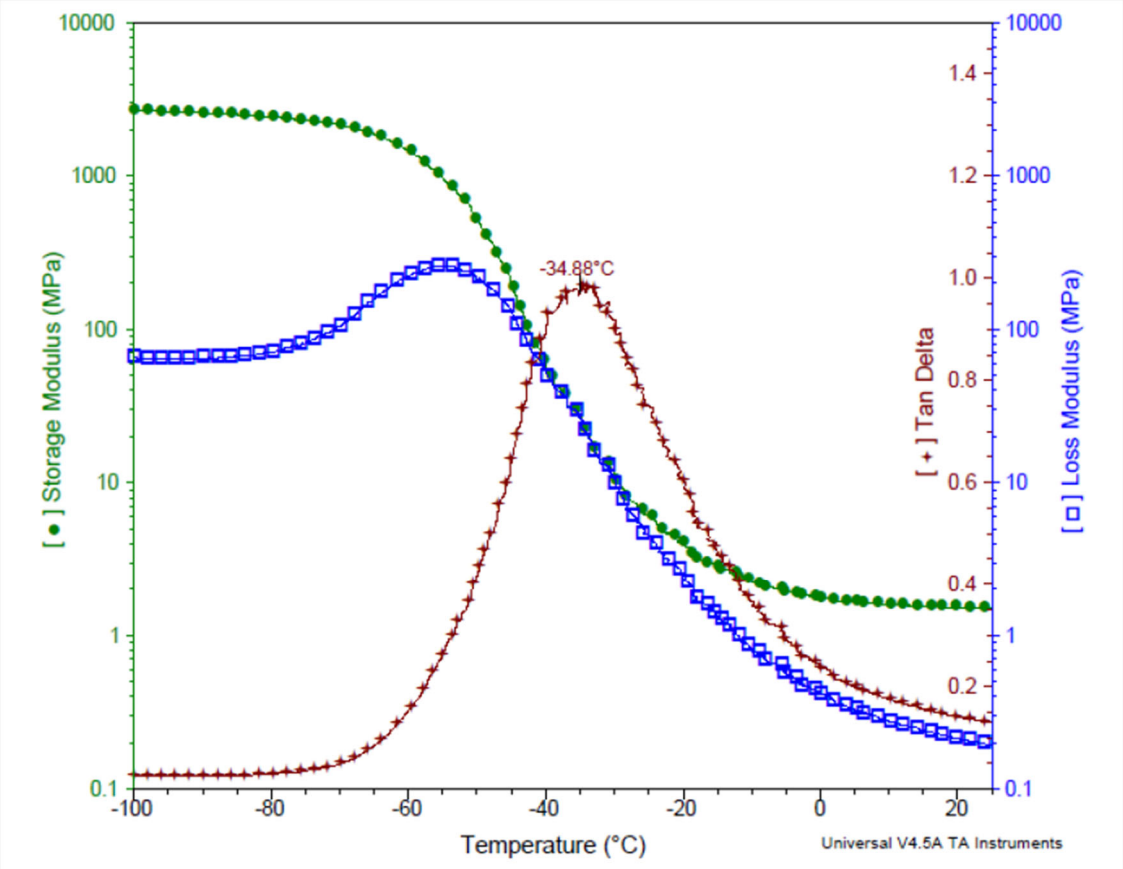
Our unique Fluro Chemistry created for -35°C Tg with low index of 1.350 tolerates tighter spooling on cooling block for higher absorption efficiency and reducing fiber usage in laser systems.

Product Code	PC-350LG
Oligomer Type	Fluoro Urethane
Viscosity (cPs)	5000
Liquid Refractive Index (589nm)	1.348
Cured Refractive Index (589nm)	1.350
Cured Refractive Index (852nm)	1.348
Numerical Aperture (NA)	0.53
Secant Modulus@ 2.5% (MPa)	5.5±0.5
Elongation (%)	90±15
Glass Transition Tg (°C)	-35°C
Decomposition 5% Td (°C)	<260°C



<High Tg Polymer Clad> <Low Tg Polymer Clad>

▪ DMA Analysis of PC-350LG

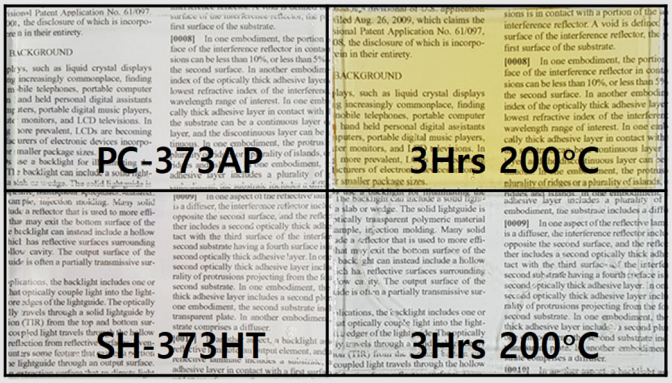


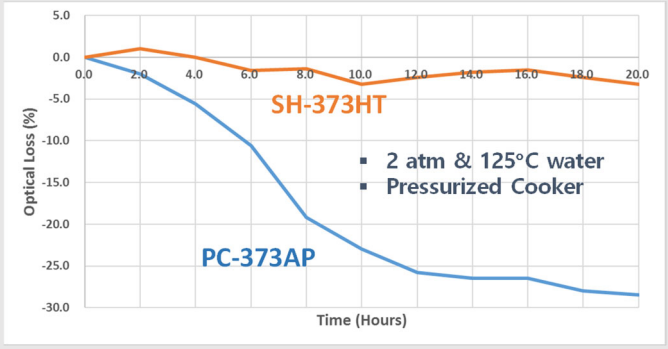
Low Refractive Index High Temperature

- **SH Series for High Temperature & High Power**

SH-HT series are formulated for high temperature operations necessary for high power fiber laser applications. Compared to our legendary PC-LAP series which showed severe yellowing, SH-HT series have no color change nor optical transmittance change after 3 hours at 200°C exposure. The SH-HT series have fluoro-siloxane chemical backbone structure that withstands high temperature continuous operation over 200˚C. The decomposition temperature T_d is higher than 350°C.

The SH-HT series with our high Tg outer jacket coating have been proved as the only solution for medical application requiring 2 atm pressure at 125°C water test. Our SH-HT coated fiber maintains beam delivery function in a pressurized 125°C water container for more than 40 hours without any optical loss.





Product Code	SH-370HT	SH-373HT	SH-380HT	SH-393HT	SH-437HT	SH-440HT	SH-525HT	SH-548HT
Oligomer Type	Fluoro Siloxane	Fluoro Siloxane	Fluoro Siloxane	Fluoro Siloxane	Siloxane	Siloxane	Siloxane	Siloxane
Viscosity (cPs)	3500	3500	3500	3500	1600	3300	40	2900
Liquid Refractive Index (589nm)	1.369	1.371	1.378	1.388	1.435	1.432	1.512	1.535
Cured Refractive Index (589nm)	1.370	1.373	1.380	1.393	1.437	1.440	1.525	1.548
Cured Refractive Index (852nm)	1.360	1.363	1.370	1.383	1.427	1.430	1.515	1.538
Numerical Aperture (NA)	0.48	0.47	0.45	0.41	-	-	-	-
Curing Shrinkage (%)	<1.5%	<1.5%	<1.5%	<2.5%	<3.5%	<3.5%	<3.5%	<3.5%
Young's Modulus (MPa)	46	45	82	330	500	700	700	100
Elongation at Break (%)	<3.0%	<3.0%	<3.0%	<3.0%	<4.5%	<3.0%	<1.5%	<9.5%
Glass Transition Tg (°C)	>300°C	>300°C	>300°C	>300°C	>230°C	>230°C	-	-
Decomposition 5% Td (°C)	293°C	289°C	284°C	288°C	>300°C	>300°C	>300°C	>300°C
Thermal Expansion Coefficient (10^{-6}/K)	260	245	230	240	209	244	369	244
Thermal Conductivity (W/mK)	0.18	0.16	0.21	0.17	0.27	0.24	0.17	0.24

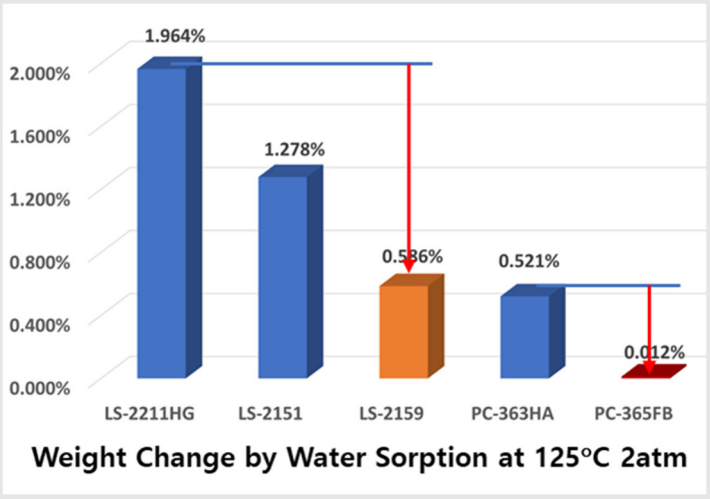
Low Refractive Index Low Water Sorption

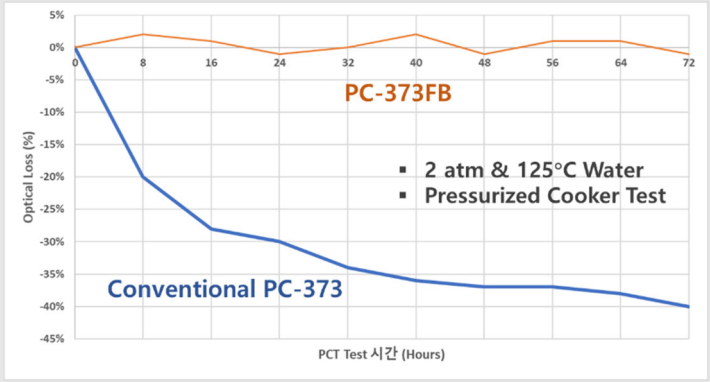
▪ FB Series for Low Water Sorption

PC-FB series, created by patented new oligomer syntheses technology, have 1/2 of oxygen content in oligomers compared to conventional low index resins like PC-HA series to reduce the water sorption even at high temperature and high-water vapor pressure.

The oxygen molecule in ether linkage of oligomer allow water molecules to diffuse easily, it is required new concept of fluoro -oligomer to reduce oxygen molecules in oligomer system and to keep high content of fluorine without crystallization which cause haze film after curing.

The water sorption is decreased by 1/10 of conventional low index coating. The active double cladded fibers coated with PC-365FB as low index cladding and LS-2159 as a secondary protective coating function properly without any delamination even after PCT 125°C & 2 atm pressurized for 72 hours





Product Code	PC-365FB	PC-370FB	PC-373FB	LS-2159
Oligomer Type	Fluoro Acrylate	Fluoro Acrylate	Fluoro Acrylate	Fluoro Urethane
Viscosity (cPs)	10,100	6,800	4,800	5,100
Refractive Index Liquid (589nm)	1.356	1.360	1.361	1.433
Refractive Index Film (589nm)	1.365	1.370	1.373	1.451
Refractive Index Film (852nm)	1.363	1.368	1.372	1.448
Young's Modulus (MPa)	55	80	80	900
Elongation at Break	15%	15%	15%	4%
Glass Transition Tg (℃)	43	45	50	82
Water Sorption at 125℃ & 2 atm PCT Test (6 hours)	< 0.02%	< 0.25%	< 0.25%	< 0.60%

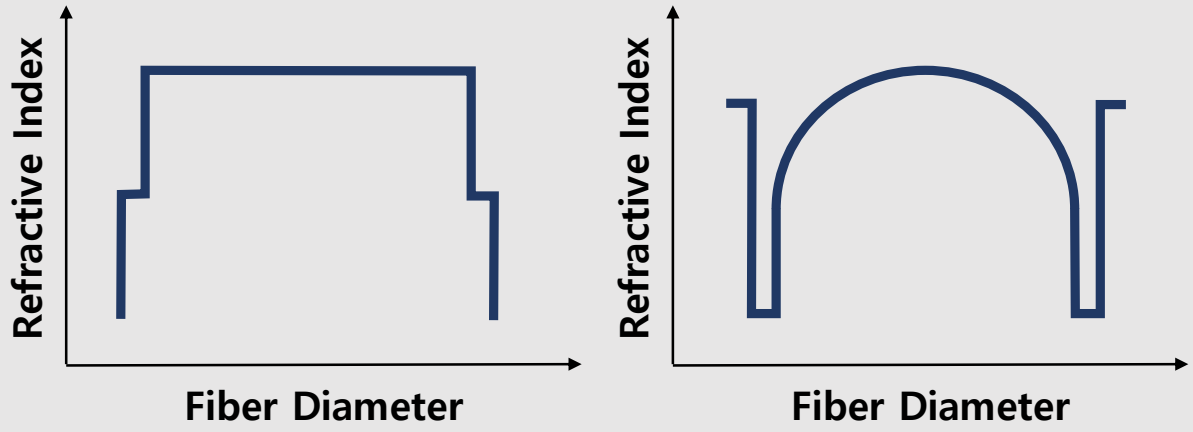
Low Refractive Index POF

▪ PC-PF Series for Plastic Optical fibers

Plastic optical fiber provide several advantage over glass fiber, albeit via a different material. Step-index fiber made from polymethylmethacrylate (PMMA) is the most commonly used for data communication applications, although there has been work on graded-index fibers based fluoro polymers.

PC-PF series provide an adhesion to PMMA. It meets all physical and optical properties required in standard fiber drawing and coating processes.

PC-PF series have also low refractive index which act as a cladding in POF. This low refractive index which increase the difference in indies between core and cladding will dramatically decrease bending loss, an essential factor to consider when using optical fiber, especially POF, in home networks.



< Refractive Index profile of high bit rate and long distance POF>

Product Code	PC-340PF	PC-400PF	PC-404PF	PC-409PF	PC-442PF	PC-452PF
Oligomer Type	Fluoro Urethane	Fluoro Urethane	Fluoro Urethane	Fluoro Urethane	Fluoro Urethane	Fluoro Urethane
Viscosity (cPs)	2700	2350	4900	1300	4900	4600
Liquid Refractive Index(589nm)	1.343	1.388	1.397	1.386	1.421	1.434
Cured Refractive Index(589nm)	1.349	1.401	1.405	1.400	1.442	1.451
Cured Refractive Index (852nm)	1.346	1.400	1.404	1.398	1.442	1.450
Young's Modulus (MPa)	1.06	200	200	336	350	667
Elongation at Break %	64%	20%	22%	15%	10%	10%
Glass Transition Tg (℃)	20	70	80	80	70	94

Regular & High Index Fiber Coating

▪ LP & LS Series for Tele-Fibers and Fiber Sensors

Primary (LP) & Secondary (LS) coating series are UV curable acrylates useful for the industrial standard ultrahigh speed fiber drawing process, and which provide high quality performance including low micro-bending attenuation, excellent field performance, and design flexibility.

LP-LG primary coating specially formulated for sensor fibers have lower glass transition temperature of -35°C which will allow more stable operations even at low temperature environment.

LP-LG : -35°C Low Tg primary coating for gyro and sensor fibers

Product Code	LP-1611	LP-1635LG	LS-2211	LS-2211HG	LS-3211	LS-950LD	LS-160HD
Oligomer Type	Urethane Acrylate	Urethane Acrylate	Urethane Acrylate	Urethane Acrylate	Urethane Acrylate	Urethane Acrylate	Fluorene Acrylate
Viscosity (cPs)	5300	3800	4500	5000	9000	2700	3500
Refractive Index Liquid (589nm)	1.484	1.462	1.512	1.492	1.484	1.483	1.576
Surface Tension (dynes · cm^{-1})	32	35	23	23	23	35	-
Refractive Index Film (852nm)	1.495	1.467	1.525	1.508	1.503	1.494	1.602
Young's Modulus (MPa)	1.3	2.6	1070	570	35	36	600
Elongation at Break (%)	115%	110%	3%	6%	15%	17%	35
Glass Transition Tg (°C)	-21°C	-35°C	58°C	107°C	40°C	40°C	-

▪ LS-HG Series for Tele-Fibers and Fiber Sensors

Conventional secondary coatings have Tg around 60°C since they are designed to be operative from 25°C to 60°C. In case of sensor fibers, they may be exposed to higher temperature and harsh environment and sometimes they may be required to be sterilized with boiling water or autoclaves where temperature exceed 100°C.

To withstand moisture penetration and high temperature, the Tg of secondary coating should be higher than 100°C with all good mechanical properties required as optical fiber coating.

LS-2211HG have all required properties like viscosity, Young's Modulus, elongation similar to our legendary secondary coating LS-2211, moreover it have higher Tg of 107°C. Combining LP-1635LG with LS-2211HG is an industrial standard coating set for optical fiber sensor.

LS-HG : > 107°C Tg secondary coating for special military & space fibers

▪ LS-LD Series for High Index Optical Fiber Coating

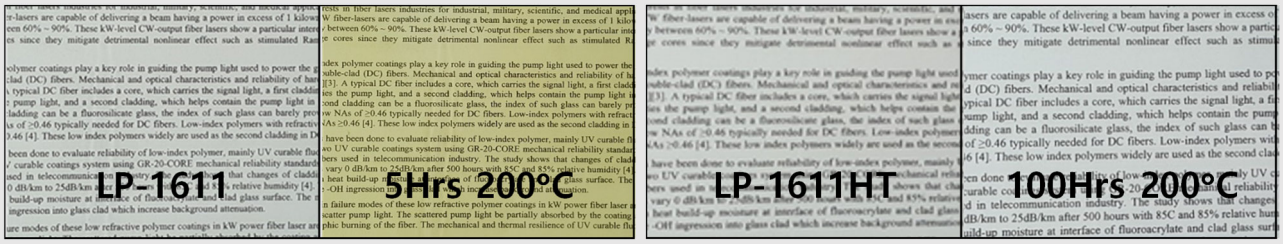
Conventional secondary coatings have Refractive Index around 1.512 since it just need to be higher than that of primary coating. Our LS-LD series have refractive index higher than 1.600 and it could reach 1.650 if needed.

High Temperature 1st & 2nd Coating

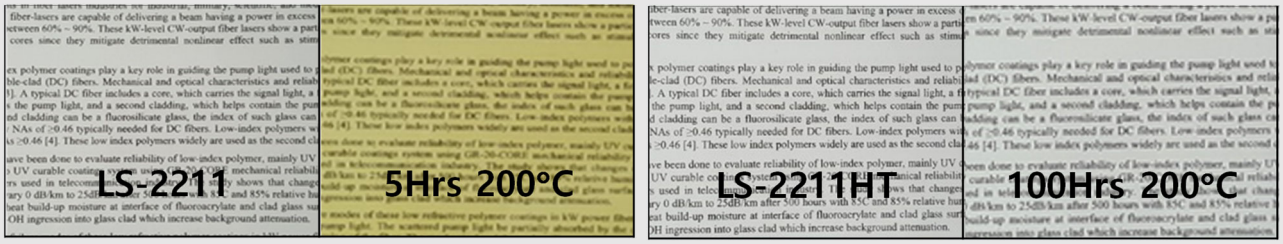
- **1st LP-HT and 2nd LS-HT coatings for High Temperature Application**

LP-HT & LS-HT, primary and secondary coatings are formulated for high temperature operations necessary for sensors, military and space applications. Compared to conventional primary & secondary coatings which showed severe yellowing after even 5 hours at 200°C, LP-HT & LS-HT series have no color change nor optical transmittance change after 100 hours 200°C exposure.

The LP-HT & LS-HT series are formulated with acrylate-siloxane (no-urethane) backbone structure that withstands continuous high temperature operation over 200˚C.



< LP-1611HT Primary Coating at 200°C >



< LS-2211HT Secondary Coating at 200°C >

Product Code	LP-1711HT	LS-2311HT	LS-2411HT	LS-3411HT
Oligomer Type	Siloxane Acrylate	Siloxane Acrylate	Siloxane Acrylate	Siloxane Acrylate
Viscosity (cPs)	5300	3000	3000	2900
Refractive Index Liquid (589nm)	1.435	1.433	1.433	1.535
Surface Tension (dynes・cm^{-1})	-	-	-	-
Refractive Index Film (589nm)	1.435	1.440	1.440	1.548
Young's Modulus (MPa)	5.2	250	250	150
Elongation (%)	60%	10%	5%	10%
Glass Transition Tg (°C)	< -100°C	>150°C	>300°C	>300°C

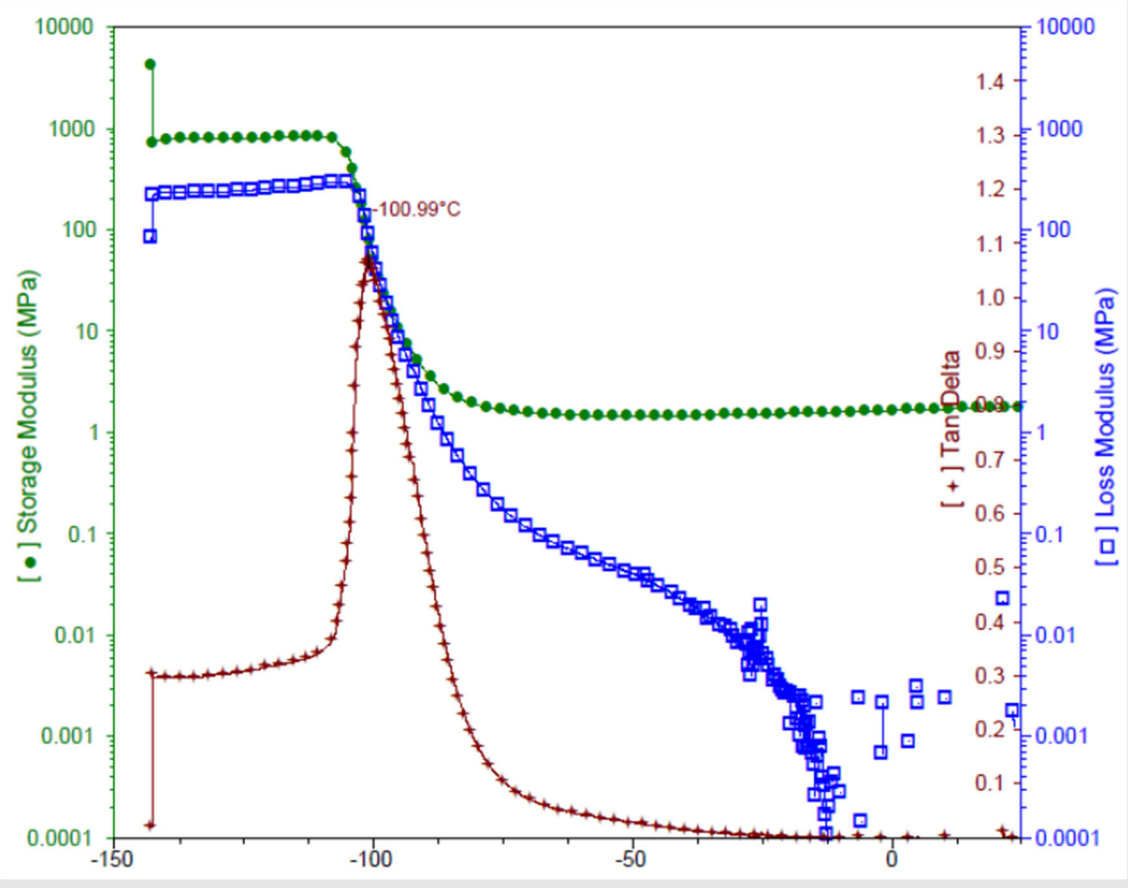
-100°C Tg Primary Coating

LP-UG Series for Ultra-Low Tg Fibers

PDMS (Polydimethylsiloxane) polymers have the lowest glass transition temperature of -125°C. Our unique siloxane chemistry create UV curable PDMS with excellent physical properties. Unlike other competitors PDMS based coating, LS-UG series have Tg of -99°C or lower with 25% elongation which give good stripping and fiber protection. LP-UG can be used in space & military applications where extreme low Tg is required.

Product Code	LP-1635LG	LP-1650LG	LP-1660UG	LP-1699UG
Oligomer Type	Urethane Acrylate	Urethane Acrylate	Siloxane Acrylate	Siloxane Acrylate
Viscosity (cPs)	3800	3400	4500	5300
Refractive Index Liquid (589nm)	1.462	1.458	1.410	1.435
Surface Tension (dynes · cm^{-1})	35	35	23	23
Refractive Index Film (852nm)	1.467	1.472	1.412	1.435
Young's Modulus (MPa)	2.6	5.8	5.0	5.2
Elongation (%)	110%	200%	70%	60%
Glass Transition Tg (°C)	-35°C	-50°C	-60°C	<-99°C

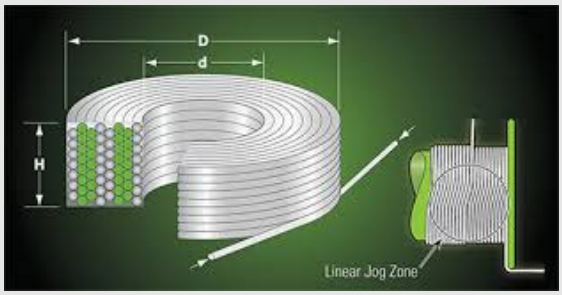
DMA Analysis of LP-1699UG



Gyro Sensor Matrix Coating

▪ LS-LV Series for Gyro Application

Matrix coating LS-LV series which have very low viscosity and low curing shrinkage can be used for Gyro Bundle, Ribbon Matrix and Fiber Bundle where size stability is critical upon curing. Unique UV & Heat dual curing technology is applied to ensure complete curing of LS-LV resin which cannot be cured by UV light because of geometry.



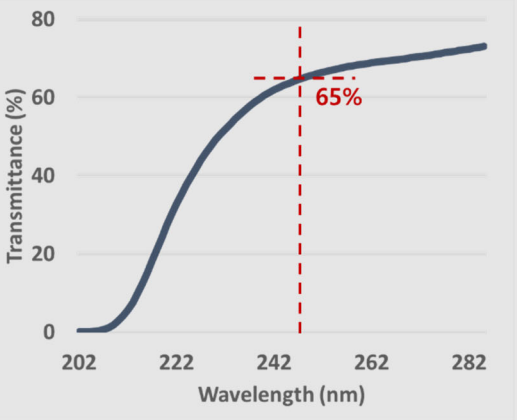
Product Code	LS-3175LV	LS-3275LV
Viscosity (cPs)	290	270
Refractive Index Liquid (589nm)	1.515	1.500
Surface Tension (dynes · cm^{-1})	39.2	42.2
Refractive Index Film (852nm)	1.529	1.518
Young's Modulus (MPa)	1900	1500
Elongation (%)	>0.4%	>0.4%
Glass Transition Tg (°C)	135℃	136℃

244nm Transparent Fiber Coating

▪ Direct UV Writing of Bragg Grating (FBG)

LS-ET series are specifically designed for 244nm UV direct writing of Bragg Grating on optical fiber core. LS-ET show more than 65% transmittance at 244nm wavelength which is used to write patterns like Brag Grating on optical fiber core.

Product Code	LS-2403ET	LS-2469ET
Oligomer Type	PDMS	PDMS
Viscosity (cPs)	1800	2700
Refractive Index Liquid (589nm)	1.401	1.405
244nm Transmittance	56%	65%
Refractive Index Film (852nm)	1.403	1.406
Young's Modulus (MPa)	2	6
Elongation (%)	130%	115%

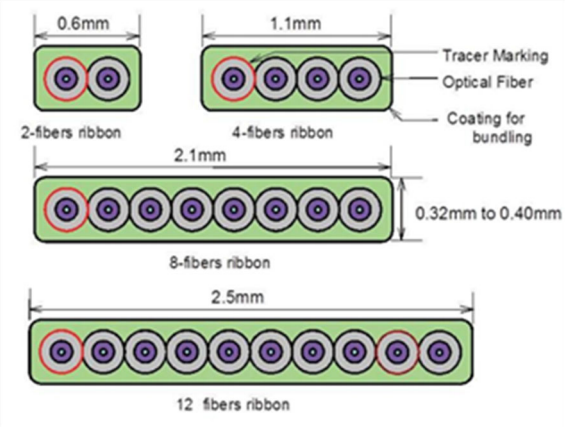


Ribbon Matrix Coating

- **RM Series for Fiber Ribbon Coating**

RM coating series are UV curable acrylates useful for the industrial standard optical fiber ribbon making process. RM series provide high quality performance including high oxidative and hydrolytic stability and excellent low friction, necessary for optical fiber industry applications.

Product Code	RM-1000	RM-9005
Viscosity (cPs)	5300	4800
Refractive Index Liquid (589nm)	1.506	1.506
Surface Tension (dynes · cm^{-1})	25	25
Coefficient of Friction mJ/cm^2	0.07	0.10
Young's Modulus (MPa)	657	118
Elongation (%)	30%	40%
Glass Transition Tg (°C)	54	78



Coloring Ink Resin

- **UVF Series for Coloring Coating**

UVF Series UV-curable inks are specially formulated to color code optical fibers. UVF inks are designed to offer maximum processing line speeds compared to other UV-curable inks, without compromising final ink performance.

Low Index Recoat Cascaded Stripping

- **PC-MS series resins for cascaded mode stripper recoating**

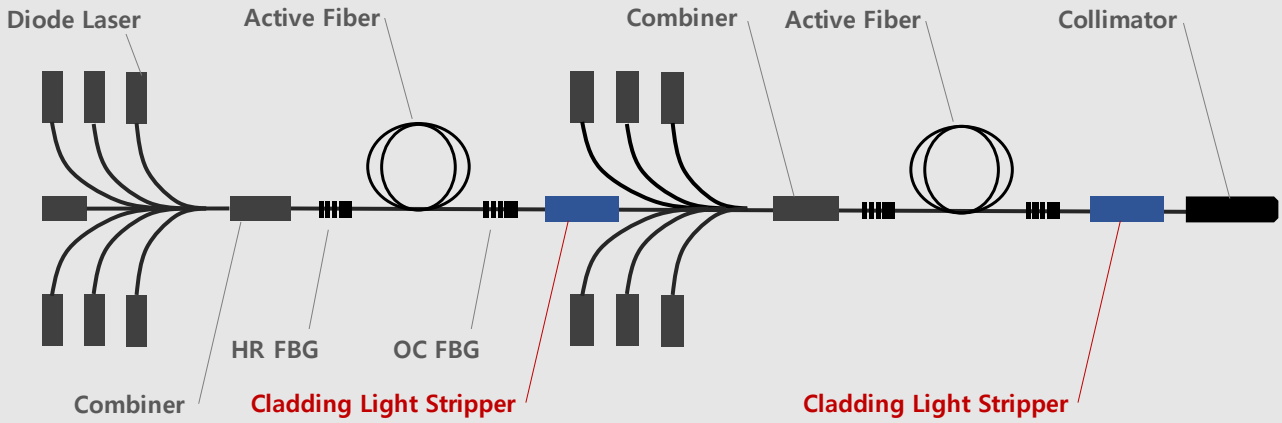
PC-4xxMS series are designed for recoating cascaded and simple cladding power stripper. The index of cured resin is precisely controlled to give consistent mode stripping power. The adhesion between glass clad and aluminum block is assured by our long history oligomer technology of PC series.

All PC-4xxMS series are miscible with each other unlike other competitors' products. This miscibility give freedom to formulate any index of cured recoating needed to control mode stripping power.

PC-4xxMHS is soft version for higher adhesion to Aluminum or Metals

PC-420MS (1.420) : PC-470MS (1.470) = 1 : 1 give precisely refractive index of 1.445 (at 589nm)

Fiber Laser Amplifier with Cladding Light Stripper



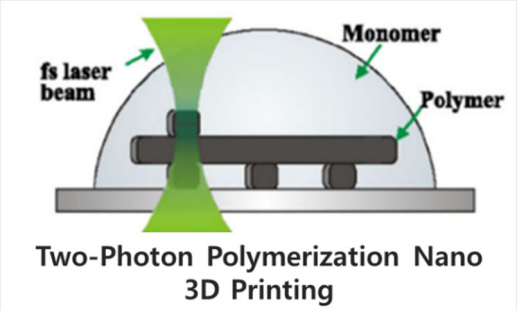
Product Code	PC-420MS	PC-450MS	PC-461MS	PC-465MS	PC-470MS
Oligomer Type	Fluoro Acrylate	Fluoro Acrylate	Fluoro Acrylate	Fluoro Acrylate	Fluoro Acrylate
Viscosity (cPs)	1090	230	160	230	270
Refractive Index Film(589nm)	1.420	1.450	1.461	1.465	1.470
Adhesion to Glass (90° Peel)	>500g/cm	>500g/cm	>500g/cm	>900g/cm	>300g/cm
Secant Modulus at 2.5%	>450MPa	>750MPa	>600MPa	>800MPa	>800MPa
Elongation %	< 7%	< 7%	< 7%	< 7%	< 7%

Product Code	PC-363MSH	PC-458MSH	PC-466MSH	PC-478MSH	PC-486MSH
Oligomer Type	Fluoro Acrylate	Fluoro Acrylate	Fluoro Acrylate	Fluoro Acrylate	Fluoro Acrylate
Viscosity (cPs)	1370	1810	1800	1920	1340
Refractive Index Film (589nm)	1.367	1.458	1.466	1.478	1.486
Adhesion to Glass (90° Peel)	<300g/cm	>1600g/cm	>1600g/cm	>1900g/cm	>1900g/cm
Secant Modulus at 2.5%	>48MPa	>107MPa	>53MPa	>146MPa	>161MPa
Elongation %	< 30%	> 100%	> 100%	> 100%	> 100%

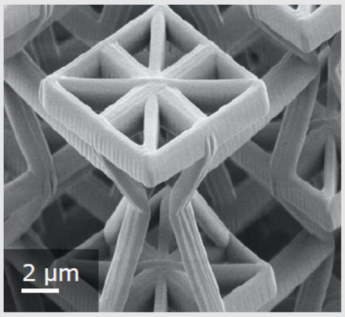
Low Index for Nano 3D Printing

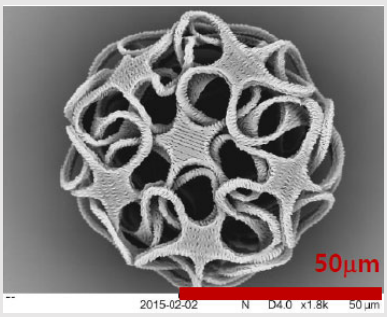
- ## ND-1321 Series Standard Resin for Nano 3D Printing

ND series is a product line of negative-tone resins that are optimized for two-photon polymerization (2PP). ND curing system provide optimized sensitivity to speeding up the Nano 3D printing cycles for scientific use cases and industrial applications in the nano-, micro- and mesoscale.



Two-Photon Polymerization Nano 3D Printing





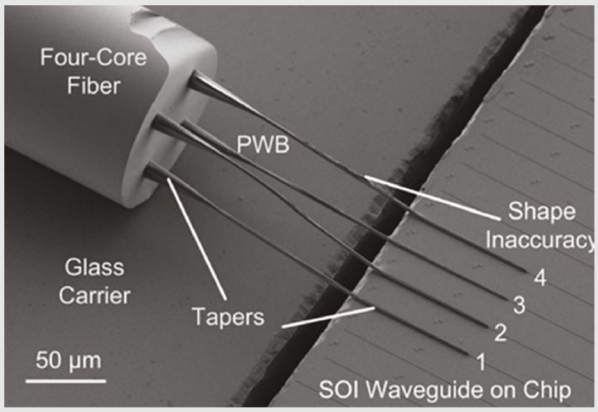
ND series is developed as standard materials for high-resolution 3D printing. High resolution and shape accuracy as well as easy handling are key features of these (meth-)acrylate urethane resins.

ND standard resins provide best performance for a broad range of applications, from micro-optics for rapid prototyping and small series production to biomedical devices such as cell scaffolds and micro-implants.

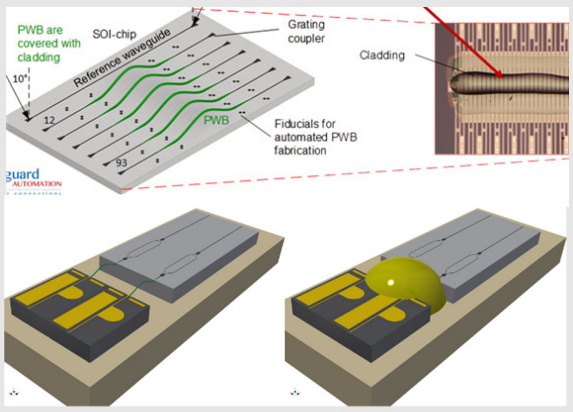
- ## ND-1321L Series Low Refractive Index for Nano 3D Printing

Photonic wire bonding is one of promising applications of two photons nano 3D printing. Micron size three-dimensional optical waveguide, designed and printed with ND standard resin, require optical low refractive index cladding as a conformal coating.

ND-1321L has 0% curing shrinkage to minimize the stress on nano scale 3D prints and low refractive index of 1.38 (at 950nm). ND-1321L has also high temperature resistance up to 300°C to provide protection from heat in a reflow process of components.



Photonic Wire Bonding by vanguard PHOTONICS bright connections



Photonic wire bonding with ND-1321L low index cladding by vanguard PHOTONICS bright connections

Low Index Optical Adhesives

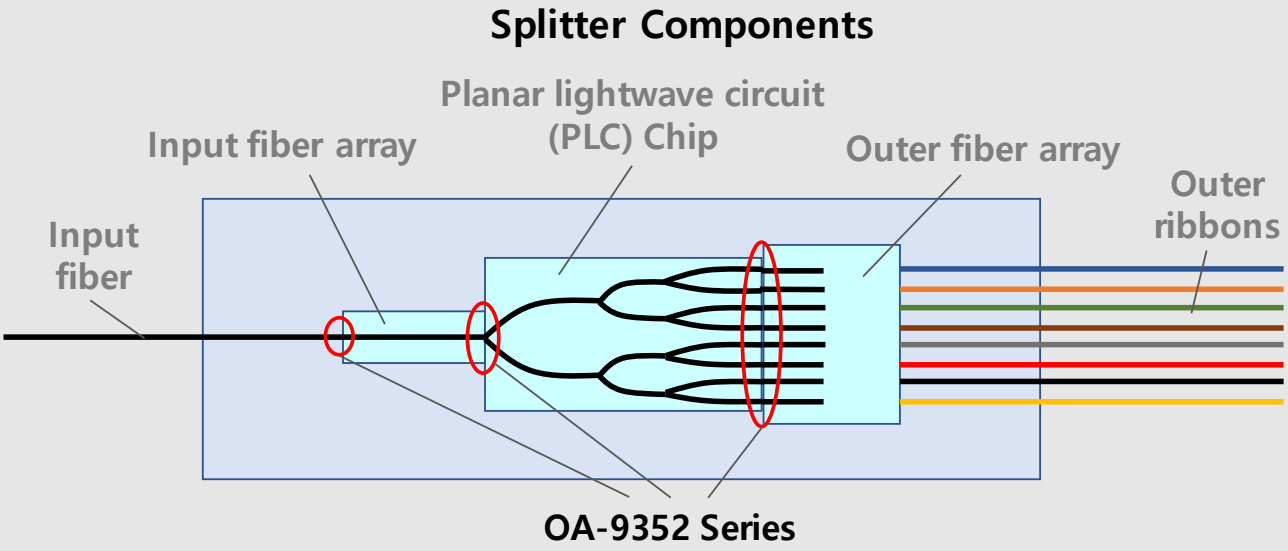
▪ OA-9352 Series Low Refractive Index Adhesives

OA-9352 series are designed for joining optical paths and fixing optical devices. OA-9352LN have low refractive index used for index matching and excellent polishing property.

All OA-9352 series passed 85°C/85% test for 5000 hour and these adhesives have been used widely in optical component industries since 1998.

OA-9352SH have excellent high temperature resistance compared other OA series. OA-9352SH have fluoro siloxane structure which is different from fluoro urethane of PC series.

All OA series are UV curable adhesives with excellent transparency and humidity resistance.



Product Code	OA9352HT	OA9352HT2	OA9352LN	OA9352LN2	OA9352LN3	OA9352SH
Features	Packaging	Excellent Polishing	Low Index	Low Index	Low Index	Low Index
Application	Splitter, AWG	Lid, Dummy Glass	Beam Path	Beam Path	Beam Path	High Temperature
Transparency	Transparent	Transparent	Transparent	Transparent	Transparent	Transparent
Oligomer Type	Urethane Acrylate	Urethane Acrylate	Fluoro Urethane Acrylate	Fluoro Urethane Acrylate	Fluoro Urethane Acrylate	Fluoro Siloxane Acrylate
Viscosity (cPs)	3500	800	400	1300	900	3500
Refractive Index (852nm)	1.463	1.472	1.393	1.385	1.395	1.393
Curing	UV	UV	UV	UV	UV	UV
Shear Strength (kgf/cm^2)	>200	>200	>200	>200	>200	-
Curing Shrinkage (%)	<7%	<7%	<8%	<8%	<8%	<5.5%
Hardness	65D	85D	60D	58D	85D	70D
Glass Transition Tg (°C)	90°C	90°C	75°C	70°C	60°C	>300°C
Decomposition 5% Td (°C)	190°C	190°C	225°C	215°C	225°C	288°C

Low Index Optical Adhesives

OA-1436 Series PDMS Acrylate Adhesives for 280°C reflow

OA-1436 series are designed for joining optical paths and fixing optical devices, specially 280°C or higher temperature process required. OA-1436 is PDMS acrylate type that withstand reflow temperature up to 300°C for short time.

OA-2436 Series PDMS Vinyl Adhesives with 0% Curing Shrinkage

OA-2436 series have a unique curing system; Pt (platinum) addition instead of radical or cationic commonly used in conventional adhesives. Because of addition reaction of vinyl PDMS, OA-2436 are UV curable and have 0% shrinkage with maintaining strong adhesion with metal and plastic.

OA-4861 Series Low Index Epoxy Adhesive with 0% Shrinkage

OA-4861 series were developed by our patented in-house low index fluoro-epoxy oligomer syntheses. It has both low index by fluoro acrylate chain and 0% curing shrinkage by epoxy functionality. We achieved the lowest index of 1.395 (950nm) epoxy compared to 1.42~1.43 competitors' epoxy with 0% curing shrinkage.

OA-4861 series are used in fixing optical components where no curing shrinkage property is critical.

FB-1583 Series UV Curable Adhesives

FB-1583 series are designed for fixing fiber ribbon array or fixing optical components with precision. FB-1583 have low curing shrinkage for precision bonding and excellent polishing property. FB series are UV curable adhesives with excellent humidity resistance.

Product Code	OA1436HT	OA2436HT	OA2436HT2	OA2436HT3	OA4861EC400	FB1583A
Features	Excellent Adhesion	No Shrinkage	No Shrinkage	No Shrinkage	No Shrinkage	Low Shrinkage
Application	High Temperature	High Temperature	High Temperature	High Temperature	Beam Path	Fiber Array
Oligomer Type	PDMS Acrylate	Fluoro PDMS Vinyl	Fluoro PDMS Vinyl	Fluoro PDMS Vinyl	Fluoro Epoxy	Epoxy
Transparency	Transparent	Transparent	Transparent	Transparent	Transparent	Opaque
Viscosity (cPs)	3200	3500	900	3200	9800	450
Refractive Index (589nm)	1.442	1.402	1.394	1.385	1.408	1.465
Refractive Index (950nm)	1.429	1.389	1.381	1.372	1.395	
Curing	UV	UV	UV	UV	UV	UV
Shear Strength (kgf/cm^2)	>200	>200	>200	>200	>200	>180
Curing Shrinkage (%)	<3%	0%	0%	0%	0%	<3%
Hardness	80D	30A	80A	30A	40D	78D
Glass Transition Tg (°C)	NA	NA	NA	NA	>150°C	90°C

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