

Luvantix ADM

UV Curable Low Refractive Index Coatings



Special Fiber Low RI Coating
High Power Fiber Coating
Recoating Resin
Display Films
Adhesives

Optical Solution Provider for Special Fibers

Low Refractive Index Coatings

Special Optical Fiber Coating & Adhesives

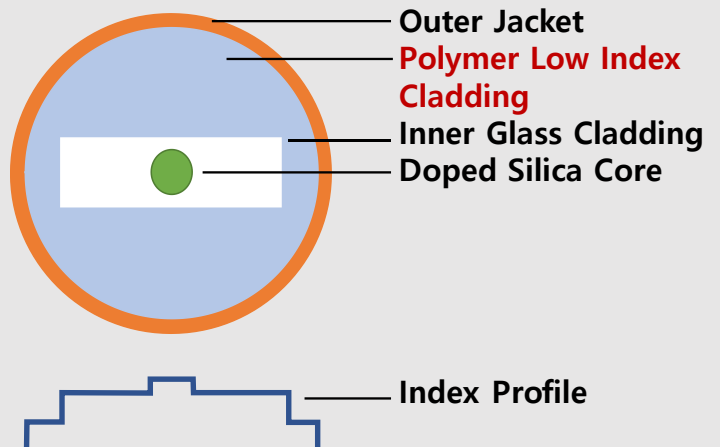
PRODUCT LIST

2019. 03.

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 index 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)	4000	6200	6500	6200	5500
Liquid Refractive Index (589nm)	1.339	1.344	1.355	1.365	1.364
Cured Refractive Index (589nm)	1.341	1.352	1.364	1.372	1.373
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)	17±5	17±5	17±5	39±5	41±8
Elongation at Break (%)	40±15	40±15	40±15	65±15	55±15
Glass Transition Tg (°C)	23°C	23°C	30°C	70°C	73°C
Decomposition 5% Td (°C)	<260°C	<260°C	<260°C	<260°C	<260°C
Thermal Expansion Coefficient (10 ⁻⁶ /K)	220	215	216	216	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)	5300	1900	4500	6300	5100
Liquid Refractive Index (589nm)	1.378	1.387	1.393	1.404	1.441
Cured Refractive Index (589nm)	1.388	1.399	1.406	1.416	1.460
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)	107±9	299±24	348±24	245±24	245±24
Elongation at Break (%)	55±15	45±15	20±5	20±5	40±10
Glass Transition Tg (°C)	75°C	75°C	84°C	90°C	82°C
Decomposition 5% Td (°C)	<240°C	<220°C	<220°C	<220°C	<220°C
Thermal Expansion Coefficient (10 ⁻⁶ /K)	210	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

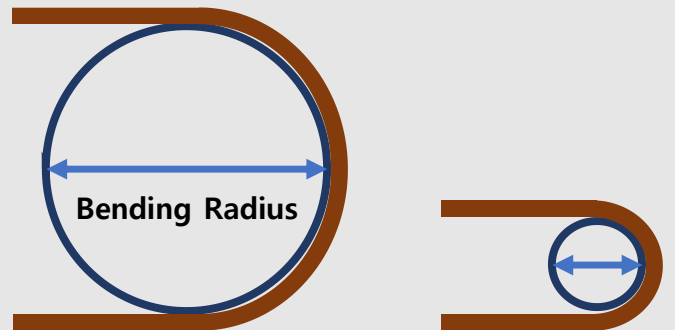
Low Tg & Low Refractive Index Primary Coating

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.

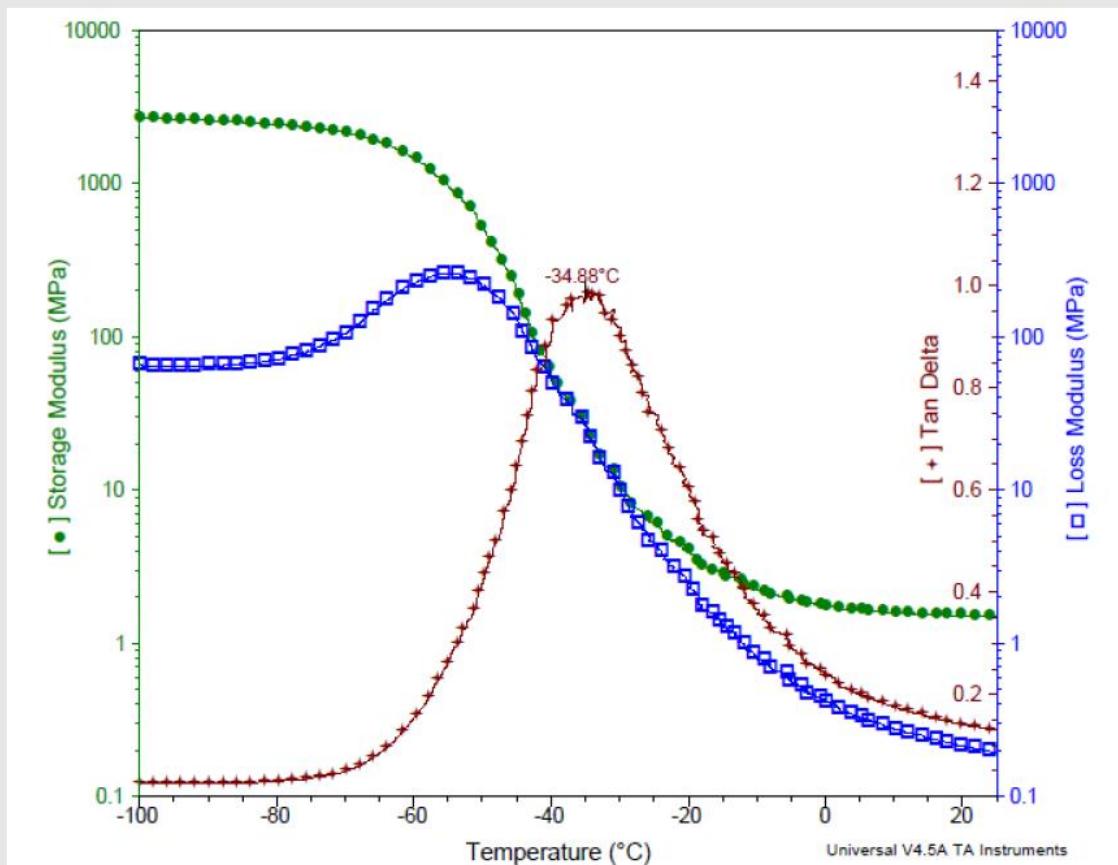
Our unique Fluoro Chemistry created for -35°C Tg with low index of 1.350 tolerates tighter spooling on cooling block for higher absorption efficiency and reducing fiber usage in laser systems.

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

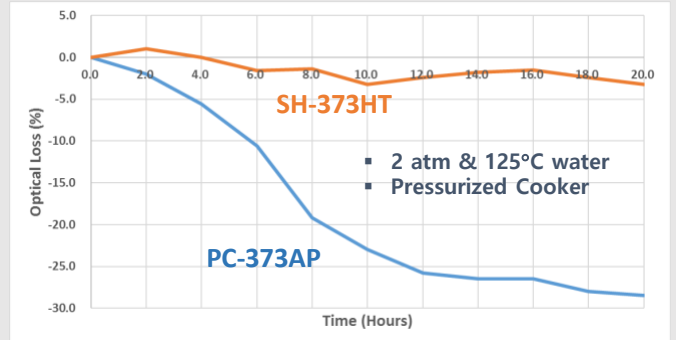
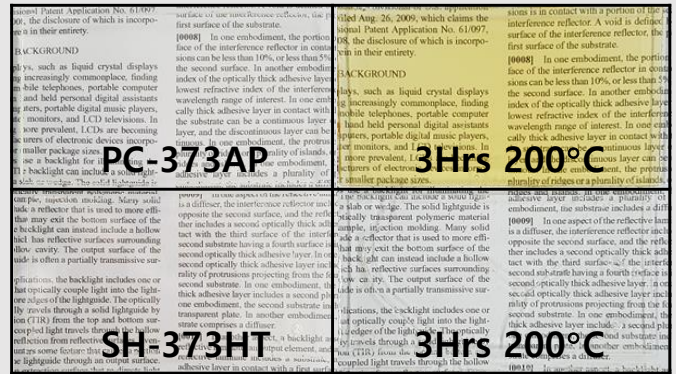


Low Refractive Index High Temperature

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 T_g 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-493HT	SH-525HT
Oligomer Type	Fluoro Siloxane	Fluoro Siloxane	Fluoro Siloxane	Fluoro Siloxane	Siloxane	Siloxane	Siloxane
Viscosity (cPs)	3500	3500	3500	3500	1600	250	150
Liquid Refractive Index (589nm)	1.369	1.371	1.378	1.388	1.436	1.474	1.512
Cured Refractive Index (589nm)	1.370	1.373	1.380	1.393	1.437	1.493	1.525
Cured Refractive Index (852nm)	1.369	1.372	1.379	1.392	1.435	1.491	1.522
Numerical Aperture (NA)	0.48	0.47	0.45	0.41	-	-	-
Curing Shrinkage (%)	<1.5%	<1.5%	<1.5%	<1.5%	<3.5%	<3.5%	<3.5%
Young's Modulus (MPa)	46	45	82	330	500	500	700
Elongation at Break (%)	<3.0%	<3.0%	<3.0%	<3.0%	<4.5%	<1.5%	<1.5%
Glass Transition T_g (°C)	>300°C	>300°C	>300°C	>300°C	-	-	-
Decomposition 5% T_d (°C)	293°C	289°C	284°C	288°C	>300°C	>300°C	>300°C
Thermal Expansion Coefficient ($10^{-6}/K$)	260	245	230	240	209	244	369
Thermal Conductivity (W/mK)	0.18	0.16	0.21	0.17	0.27	0.24	0.17

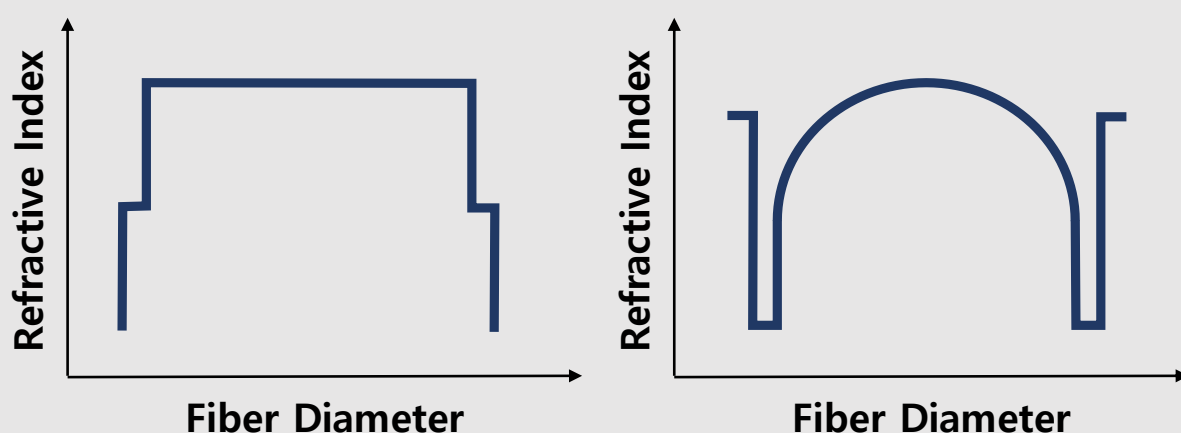
Low Refractive Index POF

■ 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 index 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 (°C)	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-950LD	LS-160HD
Oligomer Type	Urethane Acrylate	Urethane Acrylate	Urethane Acrylate	Urethane Acrylate	Urethane Acrylate	Fluorene Acrylate
Viscosity (cPs)	5300	3800	4500	5000	2700	3500
Refractive Index Liquid (589nm)	1.484	1.462	1.512	1.492	1.483	1.576
Surface Tension (dynes · cm ⁻¹)	32	35	23	23	35	-
Refractive Index Film (852nm)	1.495	1.467	1.525	1.508	1.494	1.602
Young's Modulus (MPa)	1.3	2.6	1070	570	36	600
Elongation at Break (%)	115%	110%	3%	6%	17%	35
Glass Transition Tg (°C)	-21°C	-35°C	58°C	107°C	40°C	66°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

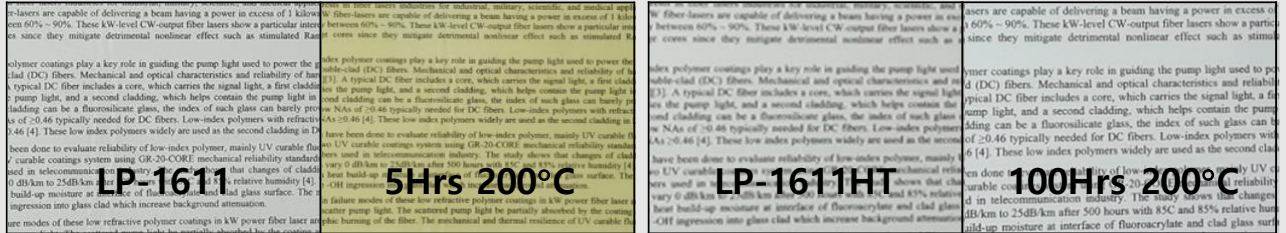
Conventional secondary coatings have Refractive Index around 1.512 since it just need to be higher than that of primary coating. Our LS-LD series have refractive index higher than 1.600 and it could reach 1.650 if needed.

High Temperature 1st & 2nd Coating

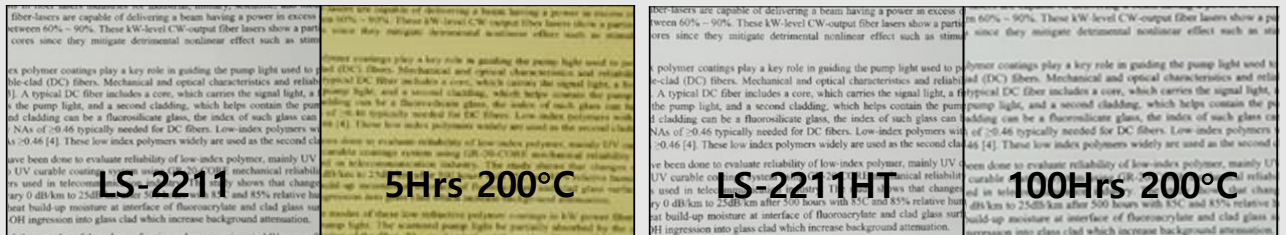
1st LP-HT and 2nd LS-HT coatings for High Temperature Application

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 at 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-1611HT	LP-1711HT	LS-2211HT	LS-2311HT
Oligomer Type	Siloxane Acrylate	Siloxane Acrylate	Siloxane Acrylate	Siloxane Acrylate
Viscosity (cPs)	2500	5300	1500	3000
Refractive Index Liquid (589nm)	1.410	1.435	1.436	1.433
Surface Tension (dynes • cm ⁻¹)	23	-	23	-
Refractive Index Film (852nm)	1.412	1.435	1.438	1.440
Young's Modulus (MPa)	5.9	5.2	500	250
Elongation at Break (%)	25%	60%	< 3.5%	10%
Glass Transition Tg (°C)	< -50°C	< -100°C	>300°C	>300°C
Thermal Conductivity (W/mk)	0.18	0.18	0.19	0.18

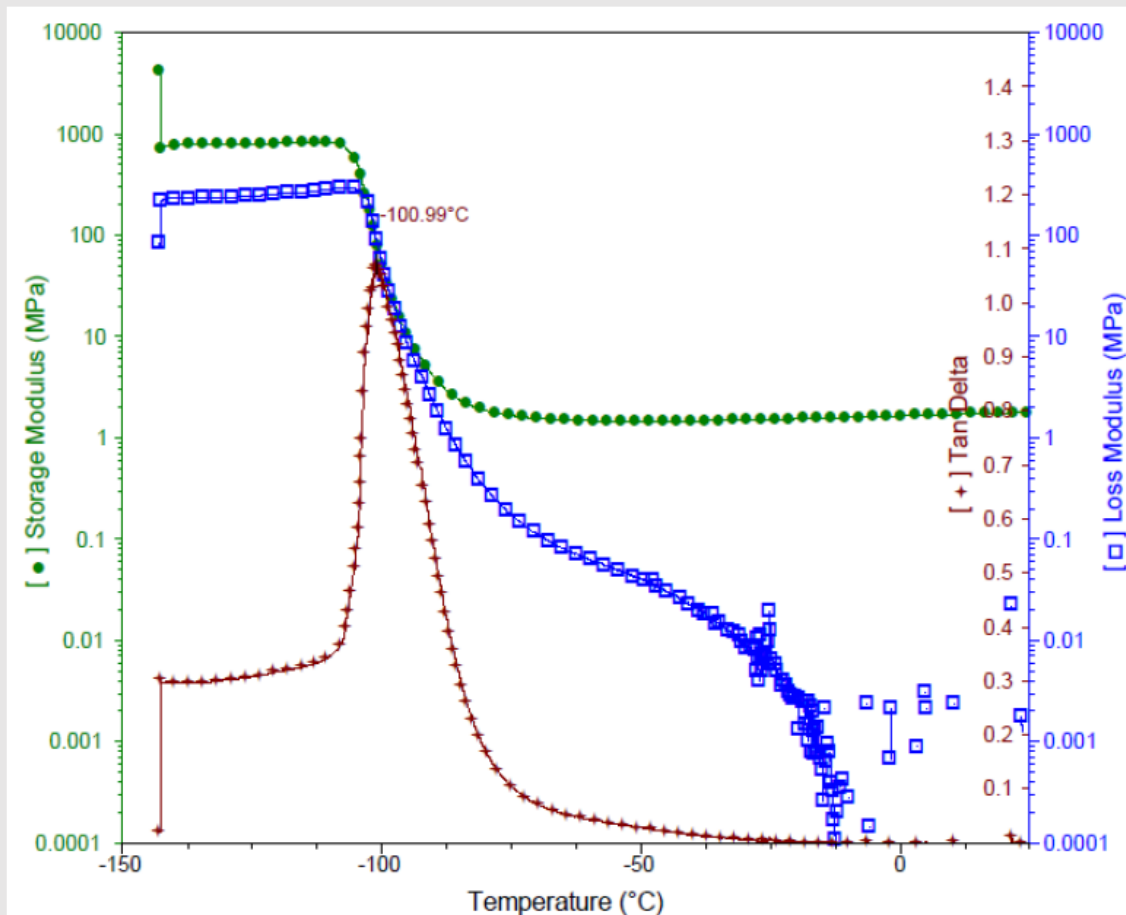
-100°C Tg Primary Coating

■ 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-1660UG	LP-1699UG
Oligomer Type	Urethane Acrylate	Siloxane Acrylate	Siloxane Acrylate
Viscosity (cPs)	3800	4500	5300
Refractive Index Liquid (589nm)	1.462	1.410	1.435
Surface Tension (dynes · cm ⁻¹)	35	23	23
Refractive Index Film (852nm)	1.467	1.412	1.435
Young's Modulus (MPa)	2.6	5.0	5.2
Elongation (%)	110%	70%	60%
Glass Transition Tg (°C)	-35°C	-60°C	< -99°C

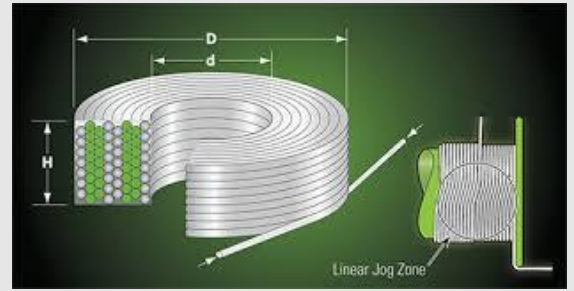
■ DMA Analysis of LP-1699UG



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°C	136°C

High Humidity Resistance Coating

■ LS Series with High Humidity Resistance

LS-2159 and LS-2454 have been developed for specifically high-power fiber laser where reliability is the essential requirement. Luvantix ADM's unique fluorene chemistry is used to minimize water absorption even at high temperature.

Product Code	LS-2211	LS-2159	LS-2454
Oligomer Type	Urethane Acrylate	Fluorene Acrylate	Fluorine Acrylate
Viscosity (cPs)	4500	6000	4000
Refractive Index Liquid (589nm)	1.512	1.570	1.430
Refractive Index Film (852nm)	1.525	1.590	1.448
Young's Modulus before test* (MPa)	1070	1400	660
Young's Modulus after test* (MPa)	321	1190	506
Modulus Drop after test*	-70%	-15%	-32%
Elongation (%) before test*	3%	5%	7%
Elongation (%) after test*	9%	5%	7%
Glass Transition Tg (°C)	58°C	> 200°C	80°C

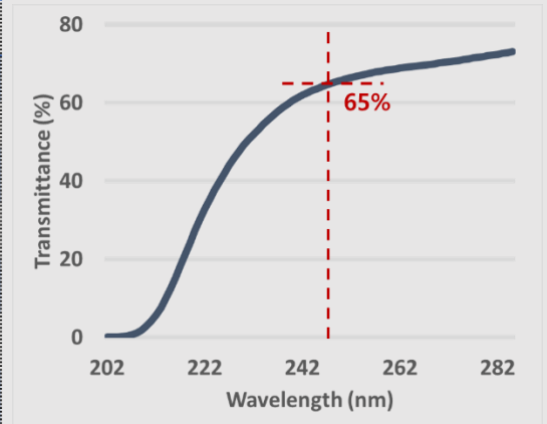
* Cured Film is submerged in Boiling Water at 100°C for 2 Hours

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 Bragg 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%

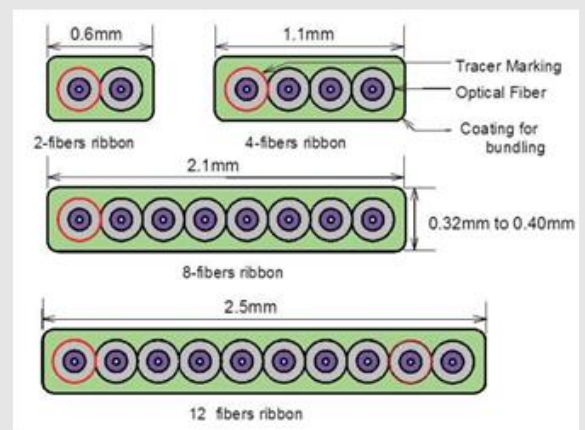


Ribbon Matrix Coating

- **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 T _g (°C)	54	78



Low Index Optical Adhesives

■ OA-9352 Series Low Refractive Index Adhesives

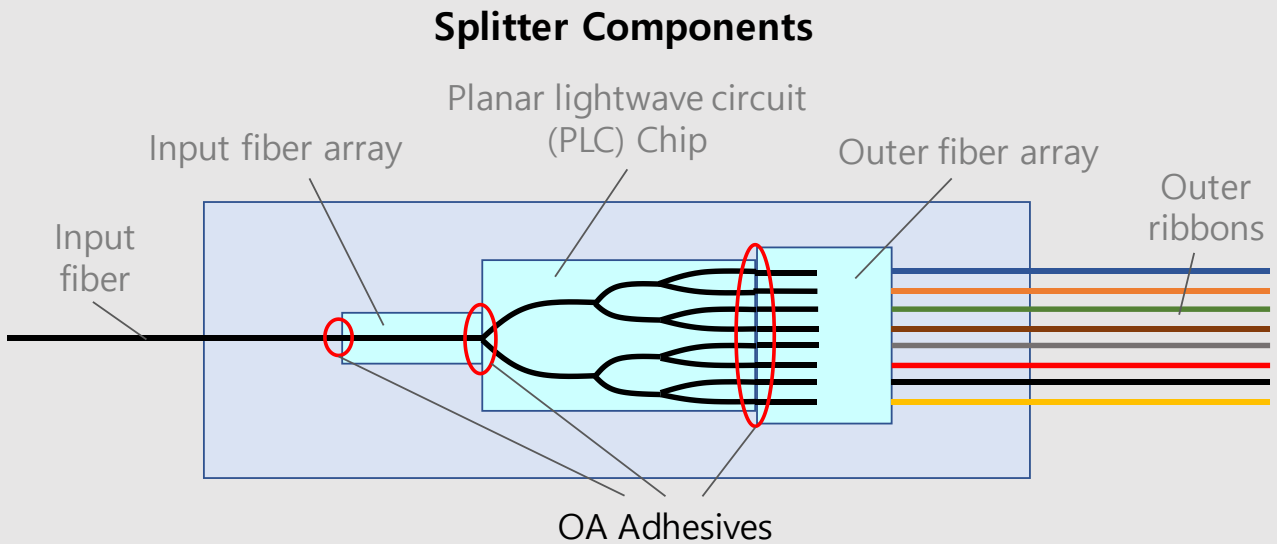
OA-9352 series are designed for joining optical paths and fixing optical devices. OA-9352LN have low refractive index used for index matching and excellent polishing property.

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.

■ 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 transparency and humidity resistance.



Product Code	OA9352HT	OA9352HT2	OA9352LN	OA9352LN2	OA9352SH	OA1437HT	FB1583A
Features	Packaging	Excellent Polishing	Low Index	Low Index	Low Index	Excellent Adhesion	Low Shrinkage
Application	Splitter, AWG	Lid, Dummy Glass	Beam Path	Beam Path	High Temperature	High Temperature	Fiber Array
Transparency	Transparent	Transparent	Transparent	Transparent	Transparent	Transparent	Opaque
Viscosity (cPs)	3500	800	400	1300	3500	3300	450
Cured Refractive Index (852nm)	1.463	1.472	1.393	1.385	1.393	1.433	1.465
Curing Method	UV	UV	UV	UV	UV	UV	UV
Shear Strength (kgf/cm ²)	>200	>200	>200	>200	>150	>150	>180
Curing Shrinkage (%)	<7%	<7%	<8%	<8%	<1.5%	<5%	<3%
Shore Hardness	65D	85D	60D	58D	70D	70D	78D
Glass Transition Tg (°C)	90°C	90°C	75°C	70°C	>300°C	-100°C	90°C
Decomposition 5% Td (°C)	190°C	190°C	225°C	215°C	288°C	>200°C	-
Thermal Conductivity (W/mk)	0.34	0.33	0.29	0.22	0.17	0.19	-
Thermal Expansion Coefficient (10 ⁻⁶ /K)	137	141	160	230	240	-	-



Luvantix ADM

Photonic solution provider

Luvantix ADM

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