CPTR-23012

TERALINKTM Cross-linked thermoplastic polymer for optical components that can withstand SMT processes

Sumitomo Electric Fine Polymer, Inc. (SFP) Sumitomo Electric Industries, Ltd. (SEI)

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Sumitomo Electric Fine Polymer, Inc. is a wholly-owned subsidiary of Sumitomo Electric Industries, Ltd. We specialize in electron beam irradiation technology and fluororesin processing technology supplying unique products to a wide range of industries including automobiles, information and communications, home electronics and infrastructure.

Company Name	Sumitomo Electric Fine Polymer, Inc.	Suita I.C ≺Kobe Sinosaka sta. Kyoto►
Address	1-950, Asashiro nishi, Kumatori-cho, Sennan-gun, Osaka, 590-0458 JAPAN TEL:+81-72-452-1301	Tokaido-Shinkansen Osaka sta. Hanshin Express Highway (Wangan-line) Kanjo Roop Line
Activities	Development and production of products made of fine polymer materials	Osaka bay Tennoji sta. Matsubara I.C Hanwa Express Hirbway
Capital	10 billion yen	Kansai
Number of employees	Approximately 480	International Airport Izumisano I.C Kumatori Kaizuka I.C

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Products



Irradiated Products

- Heat-shrinkable tubing and heat resistant tapes
 - Thermoplastic polymer components (TERALINK)
- Functional Fluororesin Products
 - Rollers for ink-jet printers
 - Porous materials made of PTFE for microfiltration



Thermoplastic polymer cross-linked by electron-beam irradiation



- Advantages
 - Structurally stable at temperatures above melting point
 - Retains original shape and transmittance under reflow process (260 $^{\circ}$ C)
 - Improved resistance to wear
 - Improved resistance to chemicals

Lens for LEDs





with cross-linking without cross-linking



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4/16

Application example:Optical Connectors

Lens package for optical connectors



Features

- Hybrid structure of lens and housing realized in single molding process
- Reflowable (260°C)

outer package for supporting lens

Applications

<**Prod.**> Optical connector (POF:650nm)



<R&D>

Optical connector (MMF:850nm etc.)



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Application example: Optical lens module for VCSELs

25Gbit/s AOC lens module



6/16

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Demonstration of 25Gbits/s transmission



No noticeable change in eye pattern after reflow

7/16

◆FRONT view



Measurement flow 1.Set AOC lens on jig and place jig on stage. 2.Measure bottom of guide-pin G1 and G2. 3.Origin is defined at center of G1 and G2. 4.Measure xy-coordinates of TX(L2),Rx(L2) for ch1~4. 5.Measure G1-G2 pitch.



- Measurement flow
- 1.Set AOC lens on stage with TX(L1),Rx(L1) facing up
- (see image on left).
- 2.Measure bottom of guide-pin G1 and G2.
- 3. Origin is defined at center of G1 and G2.
- 4. Measure xy-coordinates of TX(L1),Rx(L1) for ch1 \sim 4.

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Measurement results of shift in lens positions after reflow

*heat treatment in oven @260C x 5min.

Lens positions and G1-G2 pitch after simulated reflow*



*Lens coordinates defined to be at (0,0) before reflow



✓ FRONT view: Max shift of lens is 1.4µm
✓ BOTTOM view: Max shift of lens is 3.5µm
✓ G1-G2 pitch: Max shift is 3.5µm



BOTTOM view

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Transmittance spectrum



T>90%@650~850nm, ~90%@1300nm, 75~80%@1550nm

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Effect of reflow on transmittance



Transmittance spectrum remains virtually unchanged above 650nm

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Reliability data on transmittance



650nm ⇒ no degradation observed up to 3300h at 100° 850nm ⇒ no degradation observed up to 3300h at 120°

Material properties

	Test method	Unit	TERALINK ^{%1}	PEI
Density	ISO1183	g/cm3	1.0	1.3
Refractive index	JISK7142	—	1.51	1.64
Transmittance (2mm)	JISK7361	%	91	-
Transmittance (2mm, 650nm)	—	%	90	89
Transmittance (2mm, 850nm)	—	%	91	89
Haze	JISK7361	%	1.7	-
Glass transition temperature	ISO11357	°C	153 ^{%2}	217
Tensile strength at break	ISO527	МРа	73	110
Elongation at break	ISO527	%	29	60
Bending strength	ISO178	МРа	100	165
Bending elastic modulus	ISO178	GPa	1.8	3.5
Charpy impact strength (notched)	ISO179	KJ/m2	1.7	-
Water absorption (23°C/sat.)	ISO62	%	2.0	1.3
Water absorption (23°C/50%R.H.)	ISO62	%	1.0	-
Thermal expansion coefficient	ISO11359	10-4/K	0.9	0.6
Flammability	UL94	_	HB	V0
Specific volume resistivity	IEC93	Ω·cm	1.00E+11	1.00E+17

%1 Grade:TPN10A

%2 Teralink does not melt and keeps its original shape above Tg

13/16

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Process flow of Teralink products



- Compounding of Teralink
- Inspection (compound)
- > Injection molding
- Gate cutting
- > Inspection (molded lens)
- E-beam irradiation
- Inspection (product)
- Packaging and Shipping

Teralink compounds are not available for sale

Inspection items are determined upon customer request

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Summary

- TERALINK is a cross-linked thermoplastic polymer for optical components that can withstand SMT processes
- Features
 - Reflowable (260°C)
 - Transmittance is over 90%(600nm~1100nm)
 - Injection molding applicable (cost effective, high flexibility in design)
 - Hybrid structures of lens & supporting holder realized in a single molding process
- Applications include
- Lens for SMT-type devices with VCSELs or PDs
- Lens package for optical connectors
- Optical components for multi-mode fiber applications
- We appreciate your feedback!

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