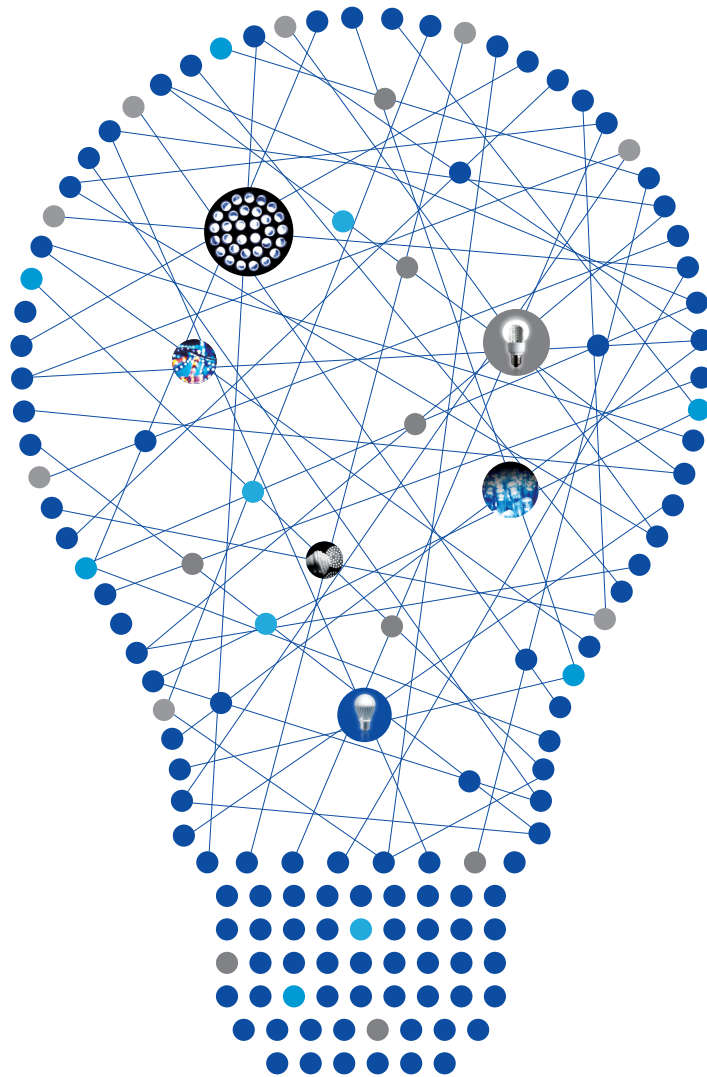


LED Lighting

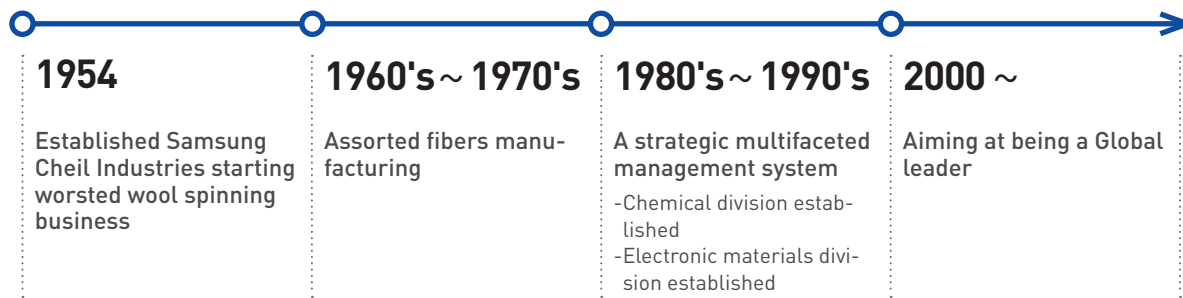
INFINO diffusion PC and Thermally Conductive Polymer
Bringing the sustainable solution



SAMSUNG CHEIL INDUSTRIES

The impetus for growth of Samsung requirements

The parent company of Samsung group established in 1954 has expanded beyond its original business in textiles to diverse global businesses such as chemicals, electronic materials and fashion apparels by continuous changes and innovation.



Chemical Division : Total Solution Provider

Samsung Cheil Industries began its chemical business in 1989 as styrenic plastics. It has since expanded rapidly into engineering plastics industry through continued investments in research and development of EP beyond typical PC.

- Started the production of ABS and PS in 1989
- C-SAN, EPS, EP plant completed in 1990's
- Started the operation of Polycarbonate plant in 2006 and completed 2nd PC plant in 2012

Samsung Cheil Industries, as one of global frontrunner in bringing technological solution, is committed in investing in product R&D and application/processing technologies that bring value-added solutions to customers and partners across the globe.

Contents

- 02 LED Lighting solution
- 03 Diffusion INFINO PC for lens cover
- 07 Thermally Conductive Polymer for heat sink
- 10 Samsung Worldwide-Global network



LED LIGHTING SOLUTION

LED market overview and requirements

LED, widely viewed as the next-generation lighting source, has a high level of power saving and can be used for classy light settings, which tends to accelerate demand. Developing new materials customized for LED is now in order.

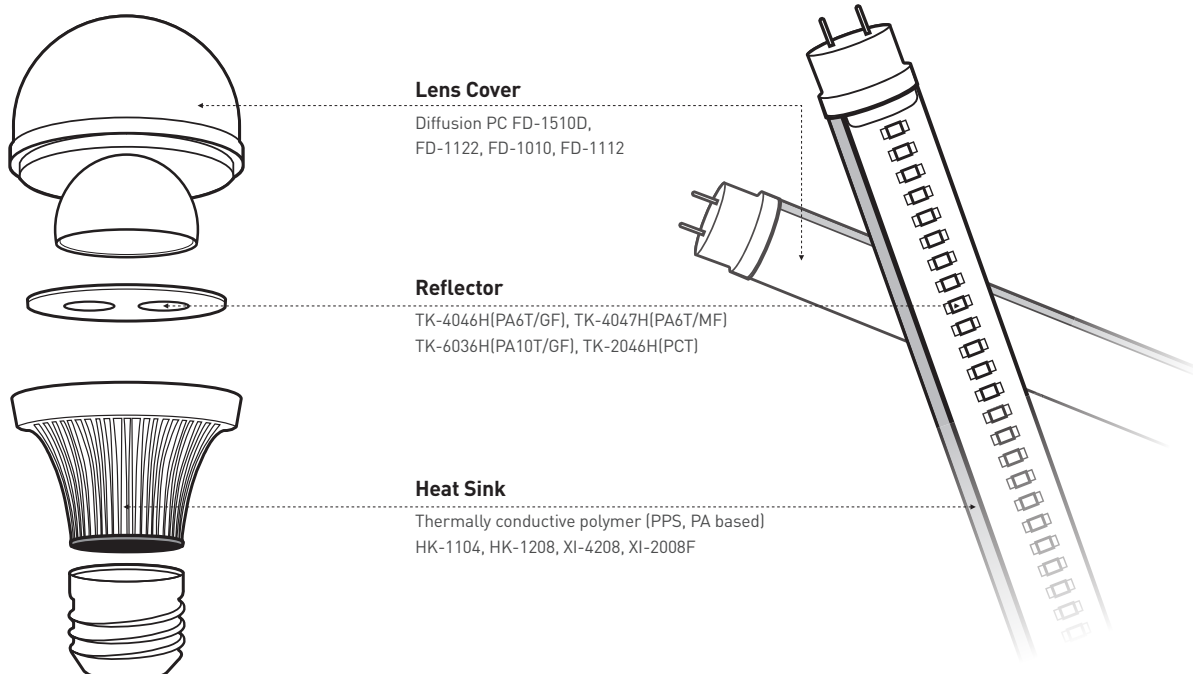
- **Requirements for LED lighting material**
 - Better energy efficiency through the prevention of electricity loss
 - Eco-friendly feature to meet the global environment regulations
 - Economic benefit through lightweight
- **Samsung Cheil Industries offers optimal material that takes the lead in the LED lighting market and is also engineered to meet the market requirements.**

To ride the dramatically growing LED lighting market, Samsung Cheil Industries has developed diffusion PC with excellent optical properties and thermally conductive material with high heat resistance and weatherability that could replace aluminum.

Product Portfolio for LED lighting

Samsung Cheil Industries has developed the double co-extrusion L-Tube, marking the first-ever product in the world. As such, the company offers the market-leading technical solutions.

- Applications : Flat panel type, bulb type, street lamp, fish lamp, factory lamp



DIFFUSION INFINO PC FOR LENS COVER

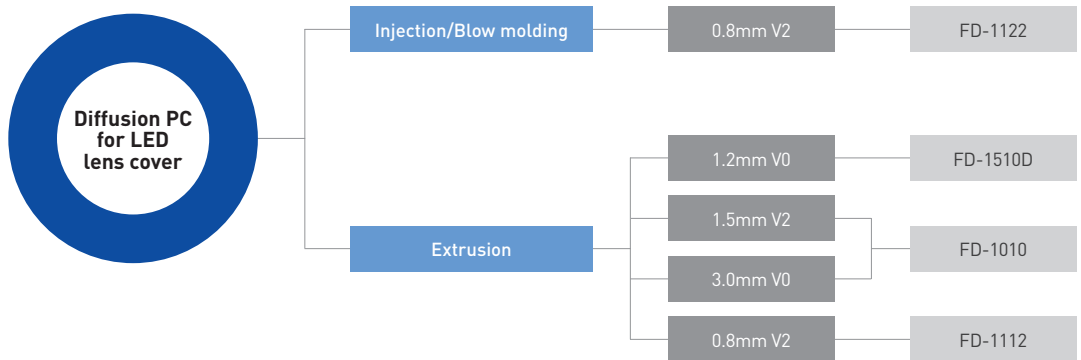


INFINO diffusion PC, developed through the combination of Samsung Cheil Industries' high-quality PC and excellent particles, has a full line-up of products with diverse diffusion/transmittance rates for different purposes.

Key Features

- **Superior optical properties**
 - Superior transparency
 - High degree of diffusion
- **Eco-friendly flame retardancy**
 - 1.2mm V0 Non-Halogen
 - Comply with Global safety regulations: non bromine, non phosphate
- **High efficiency of productivity**
- **Potentially system cost reduction**
- **Excellent injection molding process : minimize gate marks**
- **Excellent durability**
 - Excellent light resistance with low yellow index under UV exposure
 - Even if exposed to UV for a long period of time, there are few yellowing cases
 - High pyrolysis temperature

Product Guide

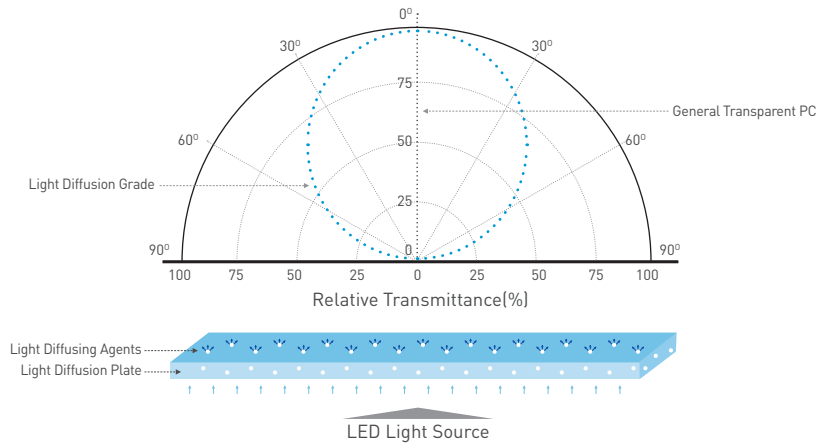


DIFFUSION INFINO PC FOR LENS COVER

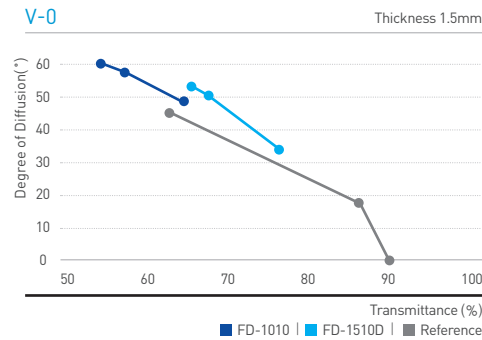


Benefits of Diffusion INFINO PC

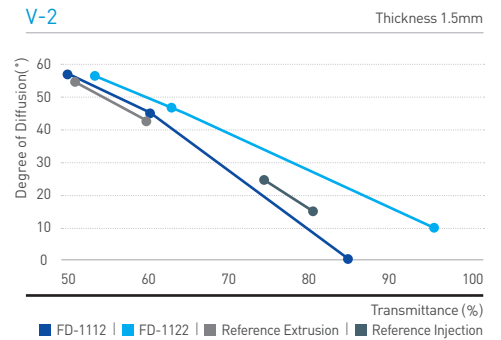
- **Transparent flame retardant PC**
 - World best transparent FR PC : non-phosgene green technology process
 - Eco-friendly flame retardancy : non-halogen system, excellent flame resistance upto 1.2mm V0
- **Tailored optical characteristics**
 - Synthesis of featured light diffusers
 - Optimization of transmittance (TT) and degree of light dispersion(DD)
- **Light diffusion flame retardant**



• Superior optical properties : High transmittance and degree of diffusion



Grade	High DD		High TT
	FD-1510D	LDW315	LDW319
FD-1010	LDW265	LDW318	LDW317

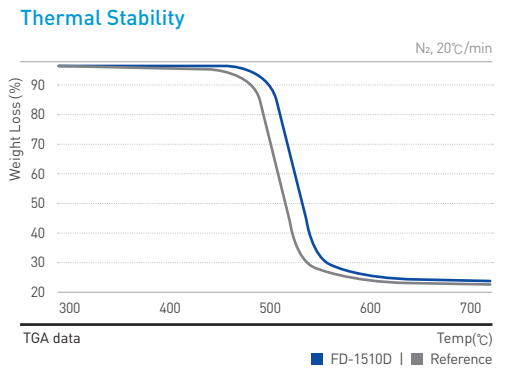
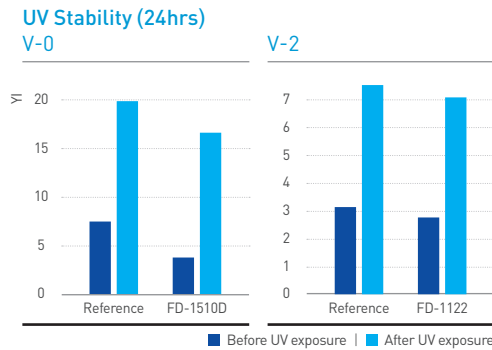


Grade	High DD		High TT
	FD-1112	LDW238	LDW213
FD-1122	LDW320	LDW309	LDW262

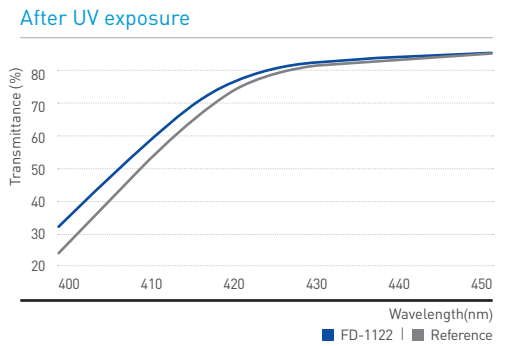
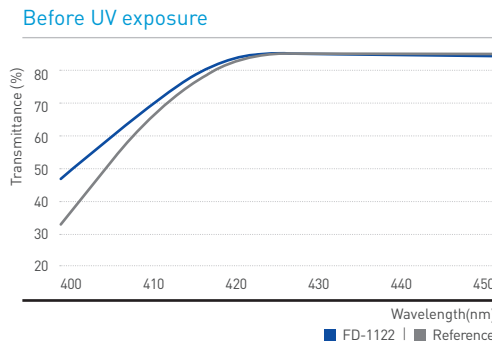
DIFFUSION INFINO PC FOR LENS COVER



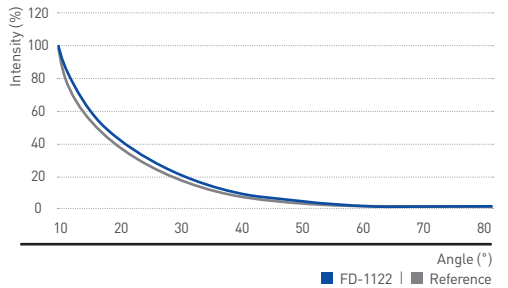
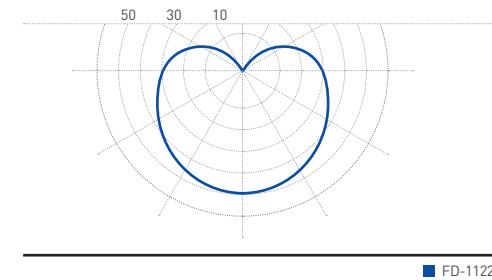
• Excellent UV stability and thermal stability



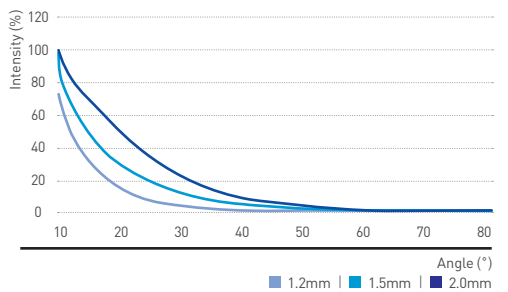
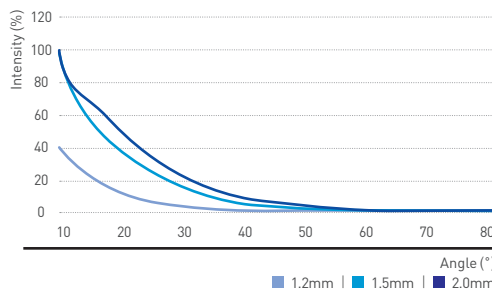
• INFINO FD-1122 transmittance levels remain at an excellent level before and after UV exposure



• Enlarged back light distribution and wider diffusion angle



• Dispersion map based on thickness : Dispersion pattern is large and even



DIFFUSION INFINO PC FOR LENS COVER



Technical Data

Properties	Test Method	Condition	Unit	FD-1510D	FD-1122	FD-1010	FD-1112
Physical Properties							
Specific Gravity	ASTM D792	Natural color	-	1.2	1.2	1.2	1.2
Melt Flow Index	ASTM D1238	250°C/10kg	g/10min	13	35	16	13
Mechanical Properties							
Tensile Strength	ASTM D638	50mm/min	kgf/cm ²	650	650	650	630
Flexural Strength	ASTM D890	2.8mm/min	kgf/cm ²	960	950	960	930
Flexural Modulus				23,000	23,000	23,000	21,000
Izod Impact Strength	ASTM D256	1/8" 23°C	kgf cm/cm ²	12	10	12	10
Thermal Properties							
Vicat Softening Temp	ISO R 306 B50	5kg, 50°C/hr	°C	144	141	144	145
Flame Characteristics							
Flammability	UL94	Thickness	-	1.2mm V0	0.8mm V2	3.0mm V0 1.5mm V2	0.8mm V2

Processing Guide

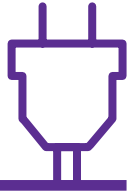
• Injection Molding

Item	Condition	
Pre-drying	4 hrs 100°C	
Cylinder Temperature	1(Hopper side)	250 ~ 260°C
	2	260 ~ 270°C
	3	270 ~ 280°C
	4(Nozzle side)	280 ~ 290°C
Nozzle Temperature	290 ~ 300°C	
Mold Temperature	70 ~ 90°C	
Injection Speed	Middle	
Injection Pressure	700 ~ 1500 kgf/cm ²	
Screw Rotation Speed	20 ~ 50 rpm	

• Profile Extrusion

Item	Condition	
Drying Temperature	100°C	
Drying Time	4 hrs	
Maximum Moisture Content	0 ~ 0.02 %	
Melt Temperature	225 ~ 270°C	
Barrel Temperature	Zone 1	215 ~ 250°C
	Zone 2	225 ~ 260°C
	Zone 3	225 ~ 270°C
	Zone 4	235 ~ 280°C
Adapter Temperature	240 ~ 290°C	
Die Temperature	240 ~ 290°C	

THERMALLY CONDUCTIVE POLYMER FOR HEAT SINK

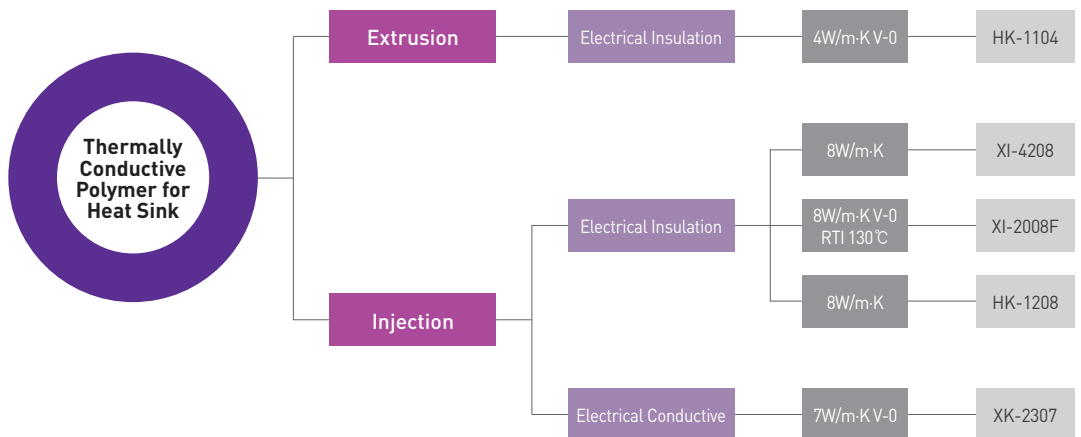


INFINO thermally conductive polymer, armed with eco-friendly flame retardancy and high heat resistance for optimal LED efficiency, is an ideal material for LED heat sink.

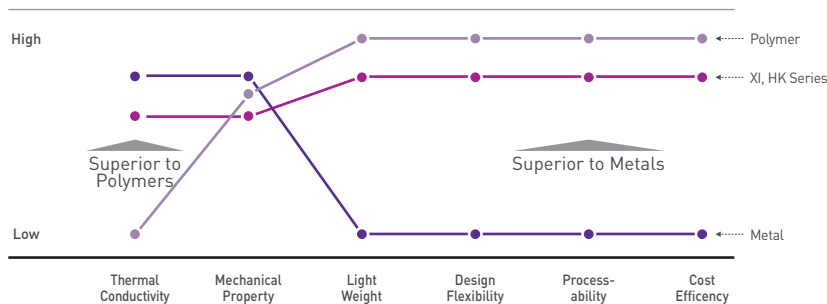
Key Features

- Eco-friendly flame retardancy
 - V-0, Non Halogen
 - Meets global safety regulation
- Color solution : white-colored grade development
- Provides color solution : development of a grade that can handle white color
- High pyrolysis temperature : efficient thermal conductivity
- Economic benefit with weight and cost reduction

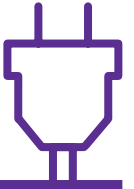
Product Guide



The polymer's inherent advantage, excellent processability and high thermal conductivity makes for an ideal protection solution against heat.

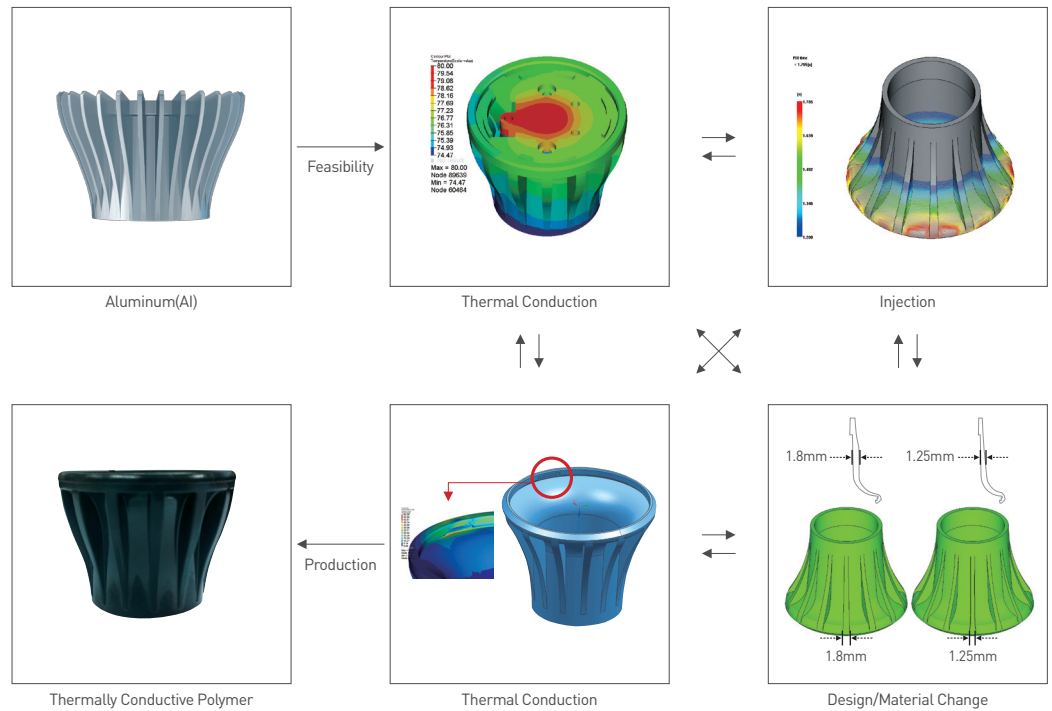


THERMALLY CONDUCTIVE POLYMER FOR HEAT SINK



To provide the optimal metal replacement, simulations are conducted to analyze thermal conduction effects and structural properties in an effort to help design the structure.

Technical Solution

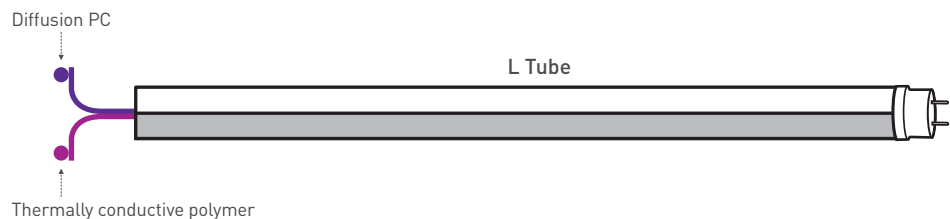


Innovative Technology

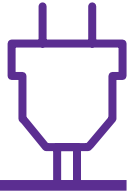
Samsung Cheil Industries' world's first double L-Tube co-extrusion

For the existing tube-type lighting, thermally conductive polymer and diffusion PC parts were separately assembled. In contrast, Samsung's new product adopts co-extrusion method, which gets rid of the assembly process in a way that secures innovative productivity level for the L-Tube.

• Co Extrusion with Light Diffusion PC



THERMALLY CONDUCTIVE POLYMER FOR HEAT SINK



Technical Data

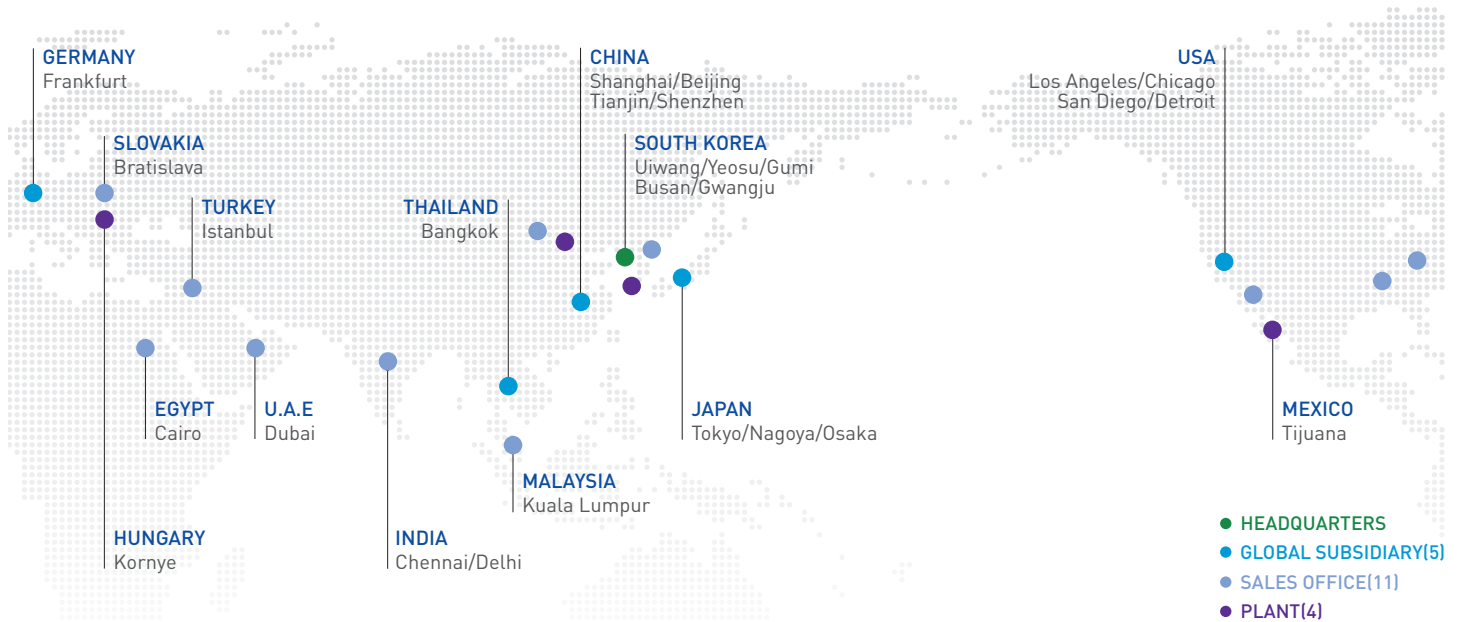
Properties	Test Method	Unit	HK-1104	HK-1208	XI-4208	XI-2008F	XK-2307
Thermal Conductivity	Cheil Method	W/m-K	4	8	8	8	7
Electrial Resistivity	ASTM D257	Ω -cm	10^{12} ↑	10^{12} ↑	10^{12} ↑	10^{12} ↑	10^3
Izod Impact	ASTM D 256A	KJ/M ²	15	8	4.0	2.0	4.6
Un-Notched			-	-	22.0	4.4	15.5
Tensile Elongation	ASTM D 638	%	10.0	6.0	2.2	2.0	1.2
Tensile Strength		MPa	37	25	60	30	90
Flexural Modulus	ASTM D 790	Gpa	3	5	6	11	18
Flexural Strength		MPa	70	50	100	60	120
Heat Distortion Temperature	ASTM D 648	°C	> 130	> 130	> 240	> 270	> 270
Mold Shrinkage(MD)	ASTM D 955	%	0.2	0.1	0.3	0.2	0.3
Mold Shrinkage(TD)			0.4	0.3	0.4	0.3	0.6
Specific Gravity	ASTM D 792		1.62	1.95	1.8	2.20	1.71

Processing Guide

Item	Injection			Profile	
	XI-4208	XI-2008, XK-2307	HK-1208	HK-1104	
Pre-drying	4hrs 100°C	2hrs 130°C	4hrs 100°C	4hrs 100°C	
Cylinder Temperature	1(Hopper side)	290 ~ 300°C	260°C	300°C	215 ~ 250°C
	2	300°C	290°C	320°C	225 ~ 250°C
	3	310°C	305°C	330°C	225 ~ 260°C
	4(Nozzle side)	320°C	315°C	330°C	235 ~ 270°C
Nozzle Temperature	310 ~ 320°C	310°C	330°C	235 ~ 280°C	
Mold Temperature	130 ~ 150°C	110 ~ 130°C	110 ~ 130°C	240 ~ 290°C*	
Injection Speed	Middle to high	Middle to high	Middle	-	
Injection Pressure	30 ~ 100 MPa	40 ~ 90 MPa	10 ~ 50 MPa	-	
Screw Rotation Speed	50 ~ 100 rpm	50 ~ 100 rpm	50 ~ 100 rpm	-	

* Adapter temperature / Die temperature

SAMSUNG WORLDWIDE – GLOBAL NETWORK



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