

Global Advanced Materials Company **LG Chem EP**



History

1947

Established as
Lucky Chemical
Industrial Co.
(now LG Chem)

1958

Established as
Goldstar Co.
(now LG Electronics)

1995

Established as a New
Corporate Identity
(Lucky Goldstar → LG)

1987

Completed
'Lucky Gold Star
Tower'

1996

Established as
LG Telecom
(now LG U+)

2017

LG Group's 70th
Anniversary

2003

Established as
LG Corp.



Sales in 2018

USD 141.8

Billion (Estimates)



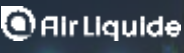
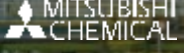
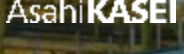
Workforce

230,000 Employees

Brand value of chemical Companies “Global No.4”

* By Brand Finance Group in the UK

Top 10 Most Valuable Brands

1	 BASF We make chemistry	—	2019 : \$8,253m 2018 : \$7,449m	+10.8%
2	 DOW	—	2019 : \$6,819m 2018 : \$6,544m	+4.2%
3	 سابك سدابك	—	2019 : \$3,964m 2018 : \$3,722m	+6.5%
4	 LG化学	▲ 5	2019 : \$3,338m 2018 : \$2,421m	+37.9%
5	 DUPONT	▼ 4	2019 : \$3,261m 2018 : \$2,685m	+21.4%
6	 lyondellbasell	NEW	2019 : \$3,073m 2018 : \$2,324m	+32.3%
7	 Air Liquide	▼ 6	2019 : \$2,594m 2018 : \$2,347m	+10.5%
8	 MITSUBISHI CHEMICAL	▲ 2	2019 : \$2,535m 2018 : \$2,259m	+12.2%
9	 PRAXAIR	NEW	2019 : \$2,307m 2018 : \$2,015m	+14.5%
10	 AsahiKASEI	▼ 7	2019 : \$2,246m 2018 : \$2,345m	-4.2%

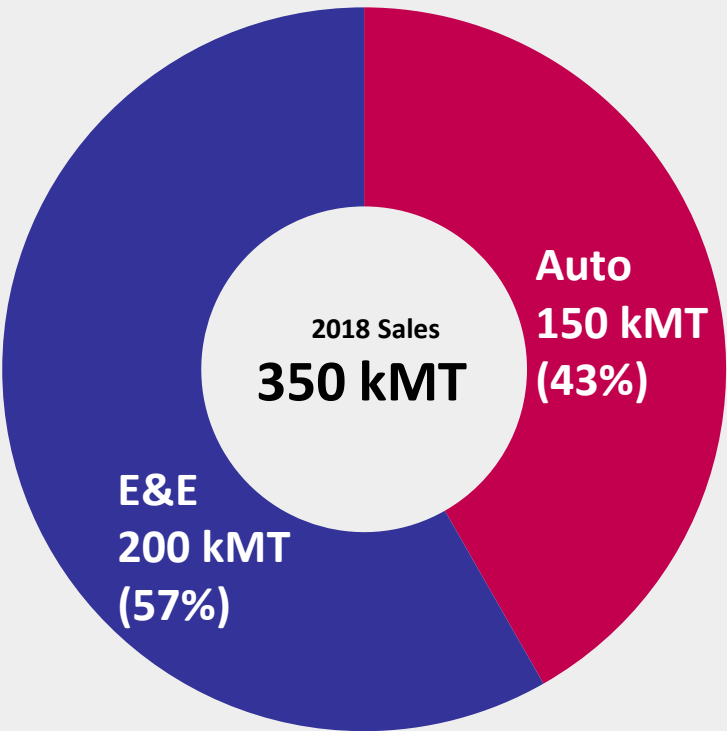
LG Chem EP Introduction



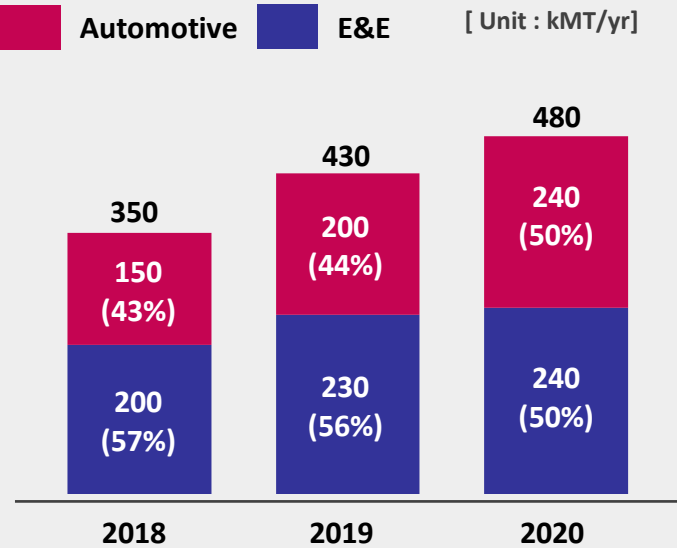
Application Strategy

E&E and Auto Application

► Application group portfolio



► Strategy



	Unit	2018	2019	2020
Total Amount	kMT	350	430	480
Automotive	kMT	150	200	240
E&E	kMT	200	230	240

End-users E&E, Auto

Accumulated expertise in global OEM validation will support new developments.

Automotive



E&E



LG Chem Poland

Optimum access to major growing markets

Venue

LG Chem Poland Sp. z o.o.
2010 (Greenfield Startup)
36.000 m²

Implementation

Jan.2011 ~ Jan.2012

Start of production

Jan. week 3, 2012

Location

Poland, Biskupice Podgórne (Wroclaw)

Workforce

~160 employees

Capacity

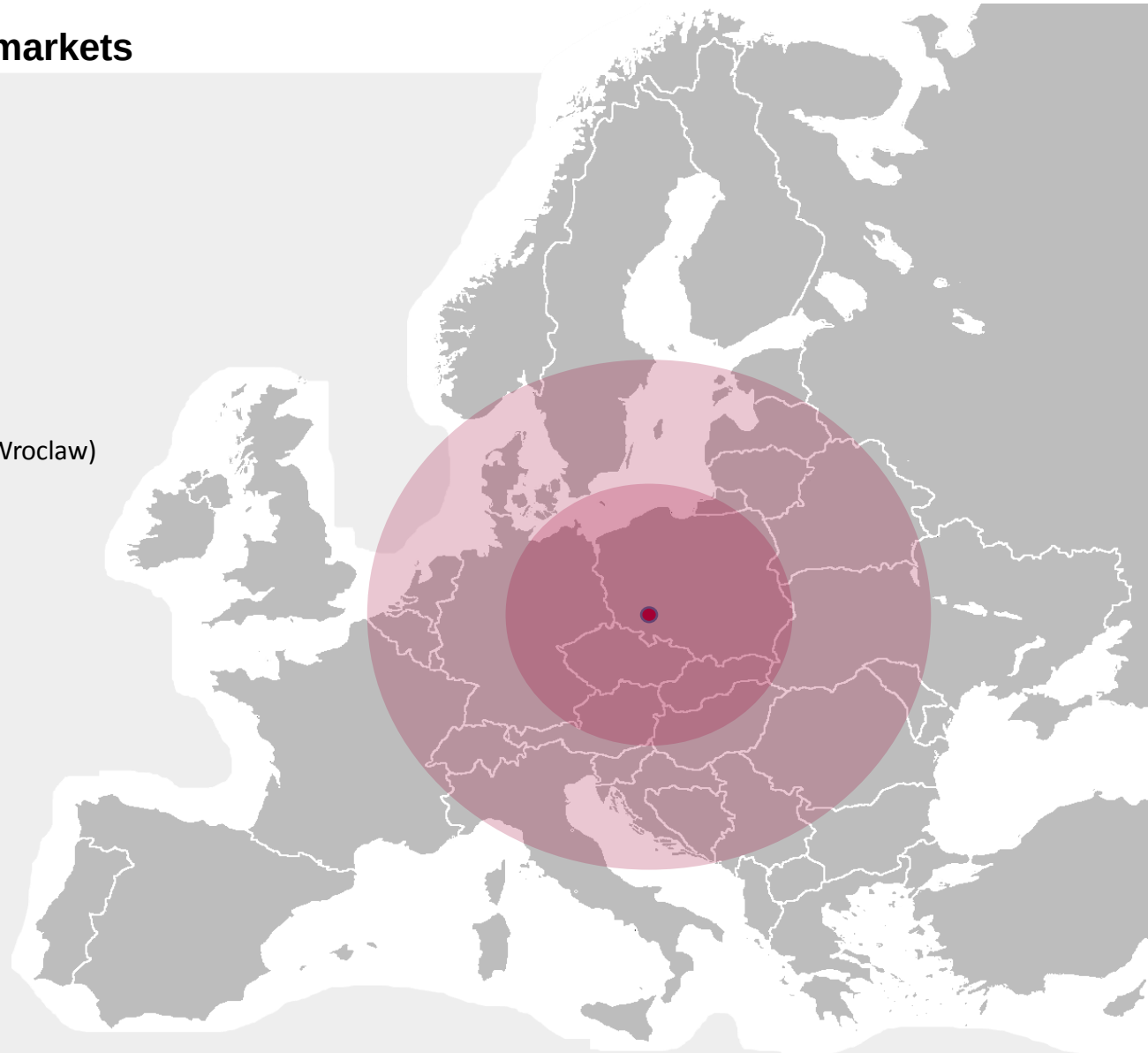
41.000 Tons a year
10 production lines

Certification

ISO 9001
ISO 14001
IATF 16949

Portfolio

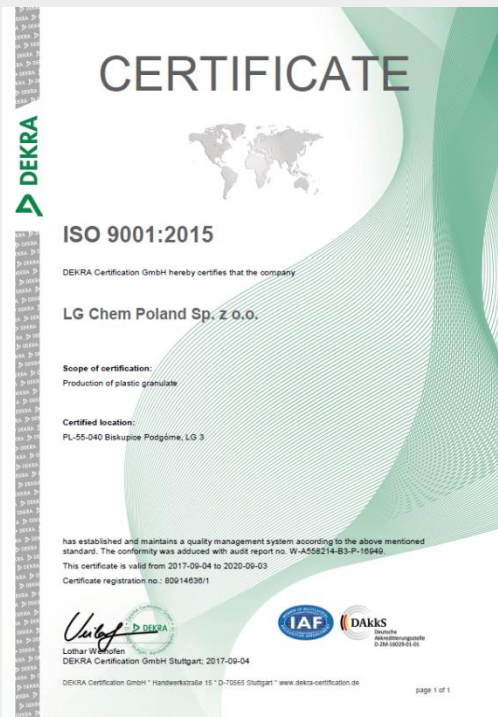
LUPOY
LUPOX
LUPOS
LUMID
LUMILOY



Reliable Product Quality



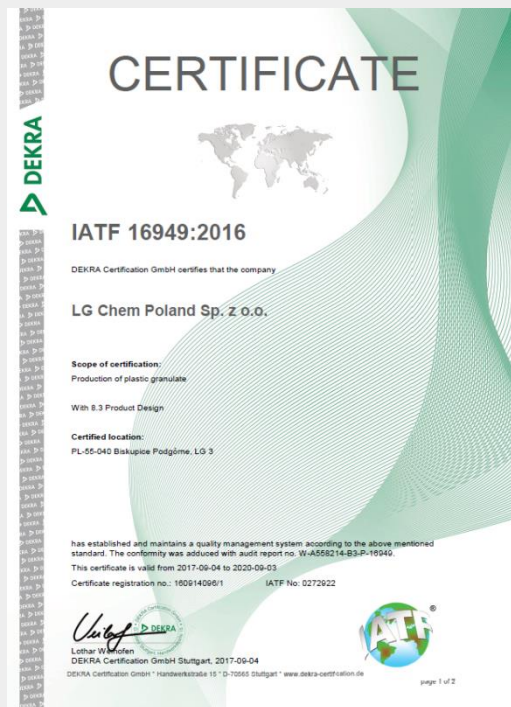
LG Chem's products are up to global quality standards



ISO 9001



ISO 14001



IATF 16949

EP materials



Engineering Plastics (EP)

LG Chem's engineering plastics(EP) processes produce high-performance materials that are more intense and lighter than general plastics. These materials are used in various applications including automobiles and electronic parts.

Applications

Exterior & Interior Decoration of a Car/ Engine Parts



TV/Mobile device



Billboards



Cable



Spectacle Lenses



Engineering Plastics (EP)

LG Chem's engineering plastics(EP) processes produce high-performance materials that are more intense and lighter than general plastics. These materials are used in various applications including automobiles and electronic parts.

Product Portfolio

Customer-oriented R&D

Wide range of product portfolio

Market-driven material development

Collaboration among LG companies

Chemical descriptions

Polycarbonate	PC PC Compound, PC alloy
Polyester	PBT, PBT Compound, PBT alloy PBT/Styrenics alloy
Polyamide	PA compound, PA alloy
TPE	TPEE (Ester Type Elastomer) TPO (Olefin Type Elastomer)
Olefin	PP Compound
mPPE	PPE/HIPS, PPE/PA alloy
Styrenics	Reinforced ABS & SAN
Acetal	POM, POM Compound
Heat Resistant Resin	PPS Compound
Conductive Resin	ABS, PS, PC, mPPE, PPS Compound

Trade name

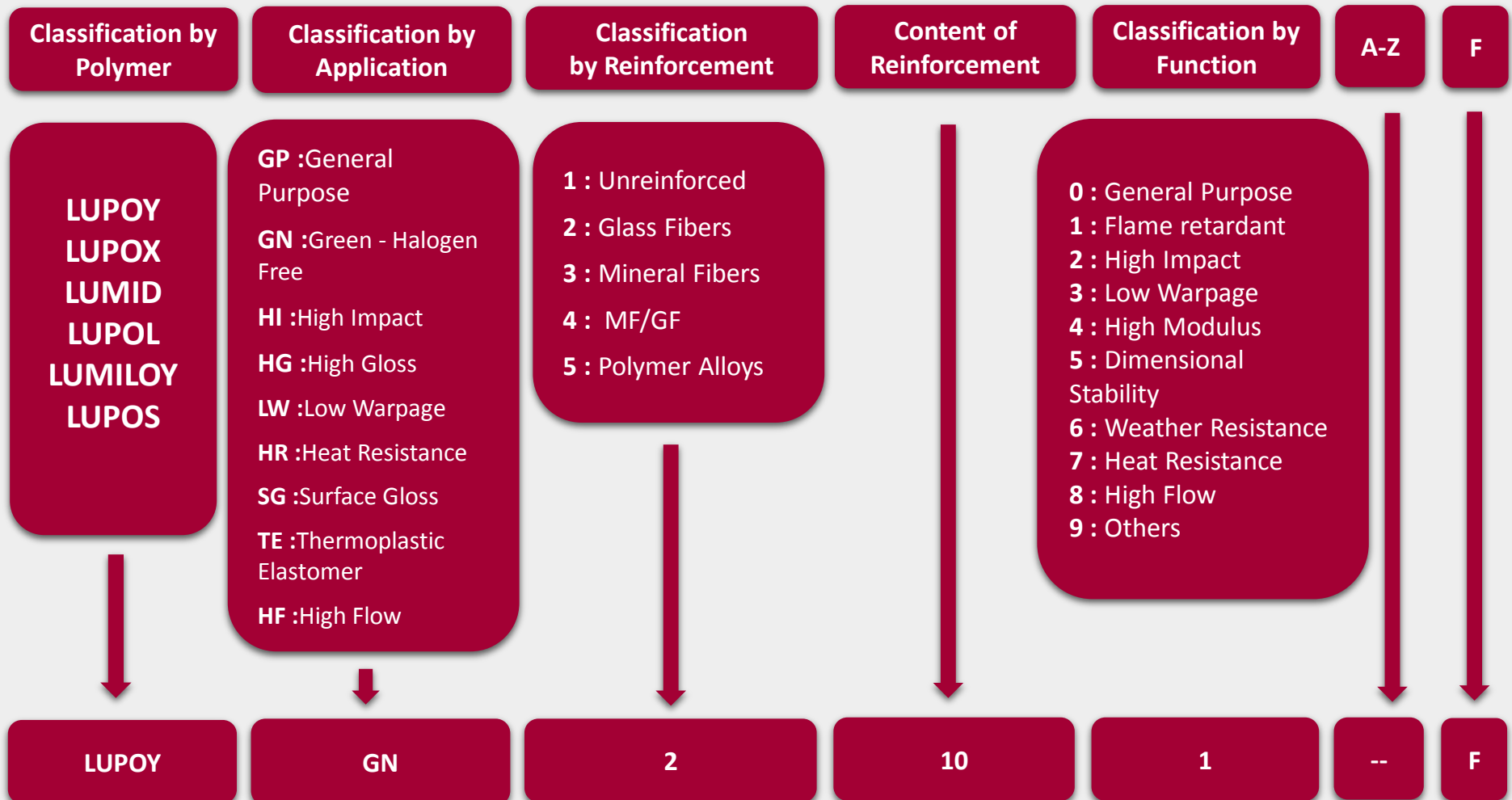
LUPOY
LUPOX LUMAX
LUMID
KEYFLEX BT KEYFLEX TO
LUPOL
LUMILOY
LUPOS
LUCEL
LUSEP
LUCON

✓ : Products from Poland Plant

EP materials

LG Chem product nomenclature

LUPOY GN2101F



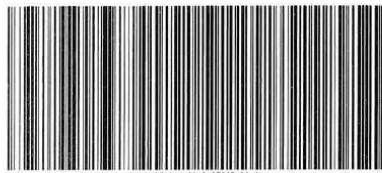
EP materials

LG Chem product nomenclature – batch number

P | **19** | **Z** | **02** | **B** | **-** | **20**

Plant Code (Poland) | Year (2019) | Month (1-9; 10=X, 11=Y, 12=Z) | Day | Line No. | Exact ton of production

GRADE	LUPOY HR5007AC
COLOR	KA02
LOT NO.	P19Z02B- 20
NET WT.	1000kg Octagon Box



LG Chem
Poland Sp.z o.o.

Line No.	Line symbol
1	A
2	B
3	C
4	D
5	E
6	F
7	G
8	H
9	M
10	N
Pilot 1	K
Pilot 2	L

Color Tone	EP Color Code
White	W0001-W9999
Ivory	I0001-I9999
Yellow	Y0001-Y9999
Orange	O0001-O9999
Red	R0001-R9999
Green	G0001-G9999
Blue	B0001-B9999
Brown	N0001-N9999
Grey	E0001-E9999
Black	K0001-K9999

EP materials - LUPOY

PC products

PC Clear

- Weatherability
- Colored PC

PC1303AH

Head Lamp Lens

GP1000M series

Interior Lighting Button

PC/ABS

- High gloss
- Low gloss

HR5000 Series
NS5000 Series

Center Fascia, Air Vent

HI5000 Series

Trim, Pillar, Trunks panel

- Metal Plating

MP5000 Series

Inside Door Handle

Radiator Grill

PC/ASA

- Non-painting
- Low Gloss

EU5000 Series

Overhead Console

Reinforced PC/ABS

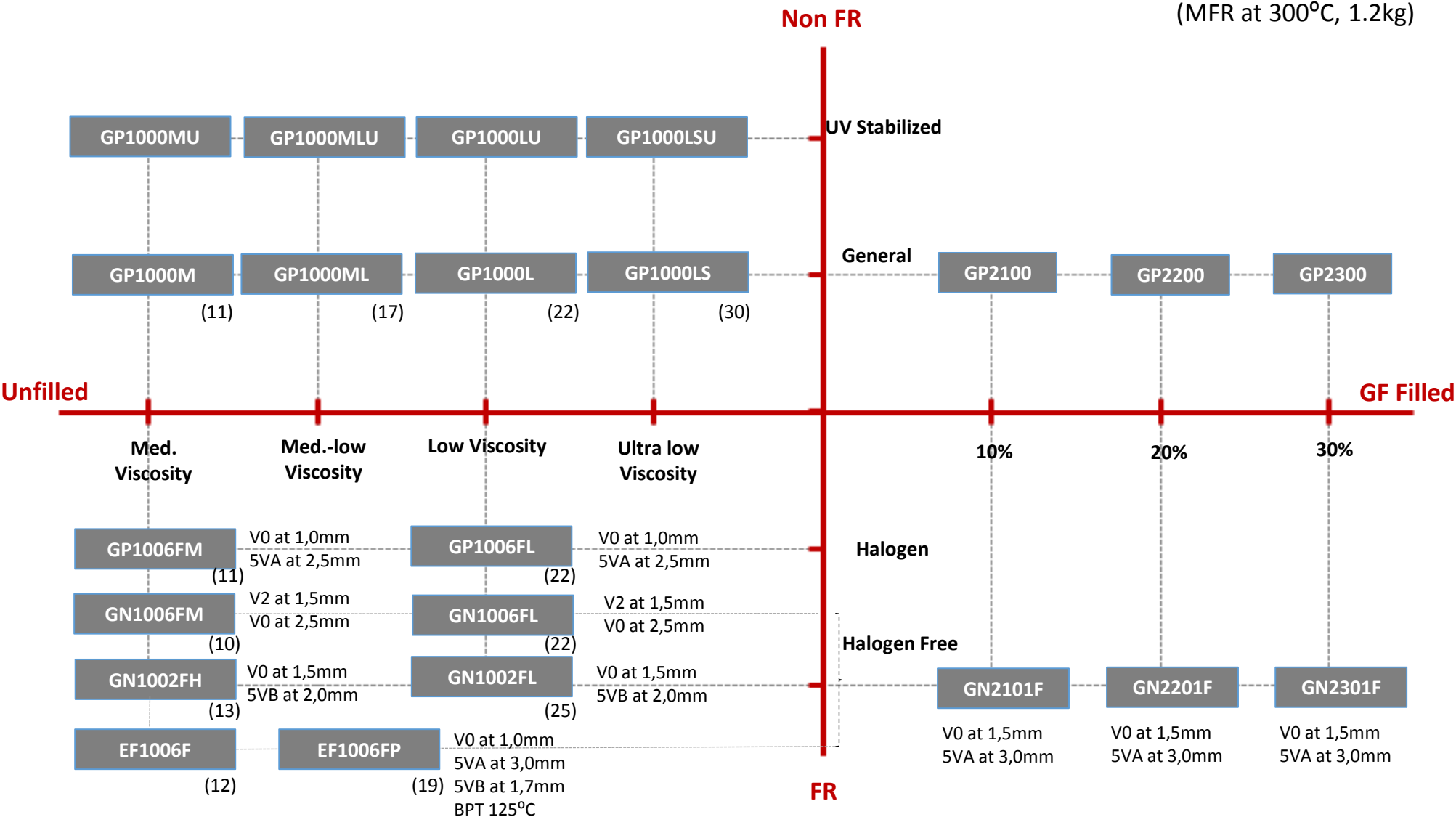
- High Stiffness

GP5000 series

Window Switch Body

EP materials - LUPOY

PC products



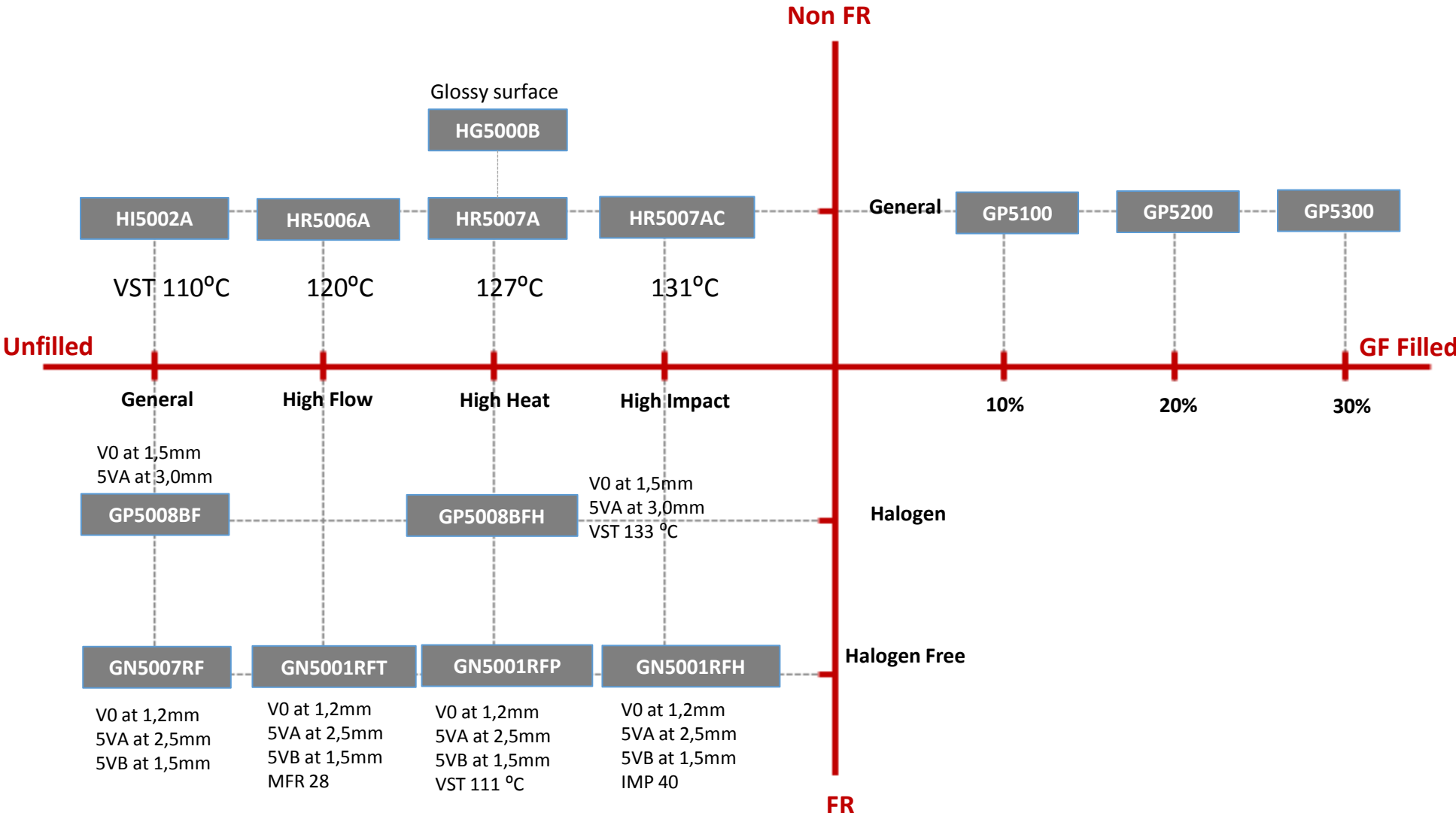
EP materials - LUPOY

PC products

PC Compounds		Properties		Corresponding Grades		
		Melt Index	HDT	Sabic (Lexan)	Bayer (Makrolon)	Others
General Purpose	GP1000M	11	130	141/143(R)	2805/2807	
	GP1000ML	17	132	121/123(R)	2605/2607	Calibre 301-15 Lupilon S300 Lupilon 3001R
	GP1000L	22	130	HF1110/1130(R)	2405/2407	Calibre 303EP
Flame Retardant (Halogen)	GP1006FM	11	130	940/943	6485/6487	Arnite T06 200SNF Ultradur B4406
	GP1006FL	22	130	920/923	6265/6287	Xantar MX1000
Flame Retardant (Halogen-free)	GN1002FH	13	118	ML6412	AL2447	Xantar FC23R
	GN1006FM	10	130	955A/AU 945A/AU 925A/AU	6555/6557 6455	InfinoTH-1100 Emerge 4610-10
	GN1006FL	22	130	915AU	2465/2665	Emerge 8330
GF Reinforced	GP2100	13	140		1095	
	GP2200	9	140			Sicoklar UG20FV
	GP2300	12	140	3433R	8345	
GF Reinforced Flame Retardant	GN2101F	8	138	505R	9415/9417	Emerge 8701
	GN2201FM	7	142	3412R/3412HF	9425/9125	Emerge 8702
	GN2301F	5	145	3413R		Xantar G6F 23R

EP materials - LUPOY

PC/ABS products



EP materials - LUPOY

PC/ABS products

PC/ABS Alloys		Properties		Corresponding Grades		
		Melt Index	HDT	Sabic (Cycloy)	Bayer (Bayblend)	Others
General Purpose	HI5002A	8	103	C10000HF	T45	Viplex A273F
	HR5006A HR5007A	4,5	108	XC620	T65/T65XF	Pulse A35-105
	HR5007AC	4	115	C1200HF	T85/T85XF	Pulse A35-110
	MP5000AM	5,5	98	CP8320	T45PG	
Flame Retardant (Halogen)	GP5008BF	5	11	C2100		
	GP5008BFH	22	123	C2100HF		Infino VB1401
Flame Retardant (Halogen-free)	GN5001EF	8	107	CE3510	FR3030	Pulse 6000BG
	GN5001RF	16	91	C2800	FR3005	Starex NH1017
	GN5001RFG	25	94		FR3008	Infino NH1027
	GN5001RFH	13	103	C2950/2951	FR3010	Infino GC1050
	GN5001RFP	20	108	CY6110	FR3110	
	GN5007FL GN5007FM	30 18	117 120	CH6410	KU2-1514	Xantar CF407 Vampaloy 0024 V0 13
GF Reinforced	GP5100	5	110	C4210/C4210HF	T88 GF10	Pulse 979
	GP5200	3	114	C4220	T88 GF20	
	GP5300	1,5	118		T88 GF30	

EP materials - LUPOY

Glass Fiber reinforced PC/ABS products

Property	Test Method	LUPOY GP5100	LUPOY GP5200	LUPOY GP5300
MVR (260°/5kg) [cm ³ /10min]	ISO 1133	17	10	7
E-Modul (1mm/min) [Mpa]	ISO 527	5000	6000	7800
Stress at yield (5mm/min) [Mpa]	ISO 527	80	97	100
Elongation (5mm/min) [%]	ISO 527	3	2	2
Charpy Impact Strength (23°C) [kJ/m ²]	ISO 179	46	38	34
Notched Charpy Impact Strength (23°C) [kJ/m ²]	ISO 179	11	9	7
HDT A 1.8MPa (°C)	ISO 75	122	114	115
HDT B 0.45MPa (°C)	ISO 75	133	123	125
Vicat Softening Temperature 50K/h 50N (°C)	ISO 306	128	120	119
Density 23°C [g/cm ³]	ISO 1183	1.18	1.26	1.33
Vertical shrinkage (%)	LG Method	0.3-0.4	0.2-0.3	0.2-0.3
Transverse shrinkage (%)	LG Method	0.3-0.4	0.2-0.3	0.2-0.3

EP specific materials



High impact & Heat Resistance PC/ABS

Various grades

Applications

AVN Housing



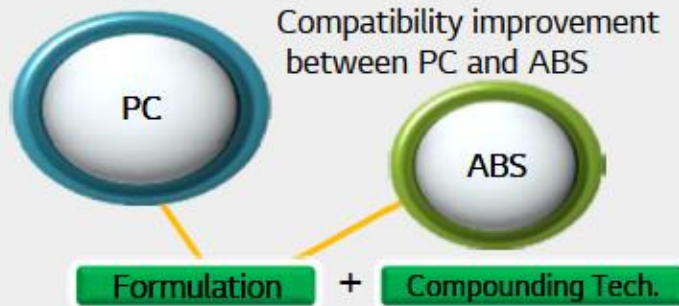
Center Facia



Cluster Bezel

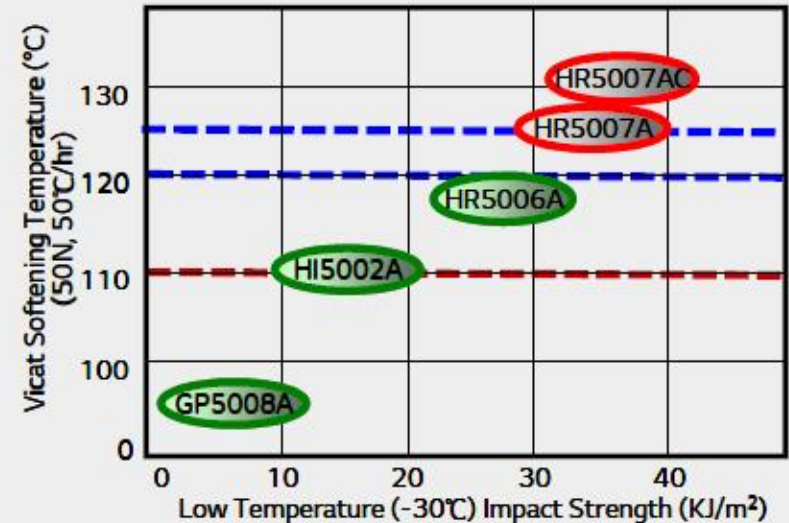


Features & Benefits



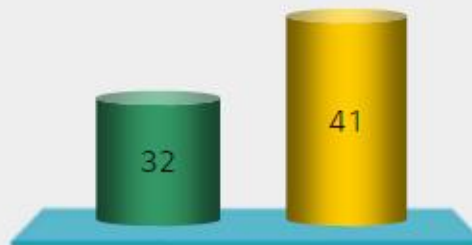
- Well balanced mechanical properties (High impact & Heat resistance)
- Good weld strength
- Head impact enhancement

Typical Properties



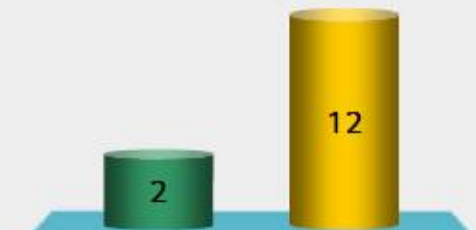
Weld Strength

Tensile strength (MPa)



General PC/ABS HR5007AC

Impact strength (KJ/m²)



General PC/ABS HR5007AC

Chemical Resistance PC/ABS

Resistance to air freshener & sunblock (LUPOY NS5000CR/CRT)

Applications

- Air vent system, Center fascia, AVN panel, Cup holder



Features & Benefits

- Globally unique material
- Excellent chemical resistance (ESCR)
- Good Impact properties at low temperature

Typical Properties

Properties		LUOY NS5000CR	LUOY NS5000CRT
Melt Index (250°C, 2.16kg)		3.7g/10min	3.5g/10min
Charpy Impact (notched)	23°C	52kJ/m ²	53kJ/m ²
	-40°C	22kJ/m ²	21kJ/m ²
HDT (1.8MPa, Flatwise)		99°C	104°C

Chemical Resistance

- Method : 0.7% ~ 2.0% Strain, 7days with Air freshener

Chemicals	Condition 1 (2% Strain, 73°F (23°C), 7 days)		Condition 2 (1% Strain, 176°F (80°C), 3 days)	
	General	NS5000CR	General	NS5000CR
Liquid Type Jasmine				
Gel Type Lavender				
Liquid Type Pine				
Liquid Type Lemon				
Sun Block SPF 30				
Results	Crack, Craze	No Crack, Craze	All Crack	Craze

Chemical Resistance PC/ABS

Improvement of painting issues (LUPOY PT5000)

Applications

- Switch bezel, Center facia, Audio panel

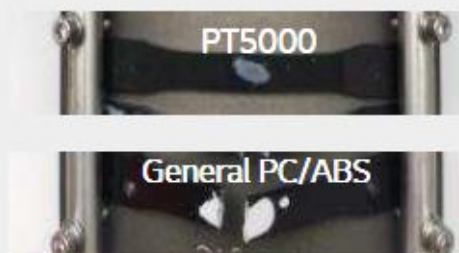


Typical Properties

Properties	Unit	High impact PC/ABS	PT5000
Density	g/cm ³	1.14	1.14
Izod Impact (Notched, 23°C)	kJ/m ²	54	55
Izod Impact (Notched, -40°C)	MPa	22	22
Tensile Strength	MPa	52	53
HDT (1.8MPa, Flatwise)	°C	107	108

Chemical Resistance

Thinner



Painting bubble issue



Features & Benefits

- High impact strength
- Chemical resistance for thinner
- Lower painting process faulty
 - : Erosion, Crack, Bubble

Non-painting Low Gloss PC/ABS

LUPOY HI5000U & HI5007U & HI5007UT

Applications

- Various interior parts (Trunk panel , Pillar etc.)

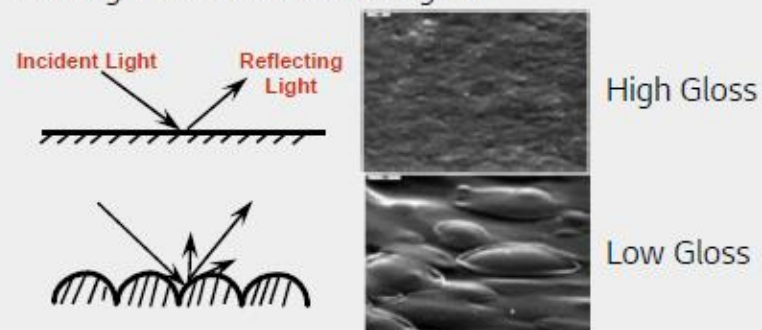


Typical Properties

Properties	Unit	HI5000U	HI5007U	HI5007UT
Density	g/cm ³	1.11	1.12	1.13
Charpy Impact (Notched, 23°C)	kJ/m ²	52	48	49
Charpy Impact (Notched, -30°C)	kJ/m ²	33	26	20
Tensile Strength	MPa	45	51	53
VST (5kg, 50°C/h)	°C	114	117	122
		DBL5404 approved	High flow Heat resistant	Meets VW TL52231 Type A

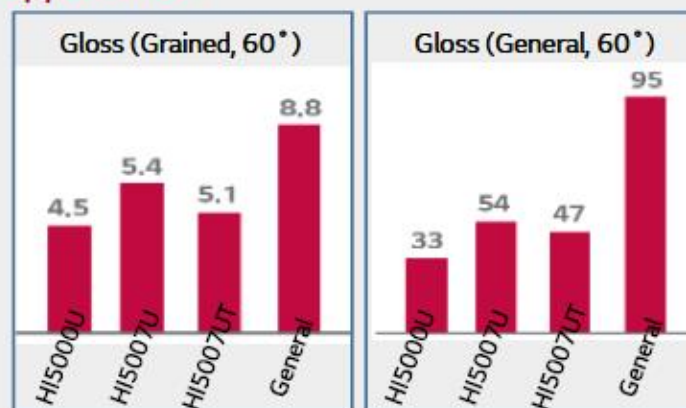
Features & Benefits

- Low gloss surface without grain



- High impact strength & good toughness
- Non-paintable with good UV stability

Appearance



Color Fastness

Method	Results
VW PV1303	Gray scale 4~5 ΔE 0.3

LG Chem Metal plating PC/ABS

General material properties comparison

Properties	Method	Unit	C company T4***	C company T6***	LUPOY MP5000AM	LUPOY MP5000AMK	LUPOY MP5000AMD	LUPOY MP5000AT
Mechanical								
Tensile Strength, yld	ASTM D638	Kgf/cm ²	490	550	470	420	470	430
Tensile Elongation, brk	ASTM D638	%	70	130	140	140	110	130
Flexural Modulus (1/4")	ASTM D790	Kgf/cm ²	20,000	23,000	20,500	19,500	20,500	17,000
Flexural Strength (1/4")	ASTM D790	Kgf/cm ²	700	810	690	620	690	630
Impact								
Izod Impact, notched (1/4"), 23°C	ASTM D256	Kgf·cm/cm	51.5	50.0	49.0	49.0	50.0	52.0
Izod Impact, notched (1/4"), -30°C	ASTM D256	Kgf·cm/cm	21.5	21.5	27.0	33.0	35.0	39.0
Thermal								
HDT, 18.6 kg/cm ² , 6.4mm, unannealed	ASTM D648	°C	96	102	98	97	107	105
Physical								
Specific Gravity	ASTM D792	g/cm ³	1.08	1.12	1.11	1.10	1.12	1.12
Melt Flow Rate (250°C, 2.16Kg)	ASTM D1238	g/10min	2.5	4.6	3.7	3.0	1.9	2.6

LG Chem Metal Plating PC/ABS

Adhesion Evaluation of Plating

Peel off strength test

Test conditions

- Specimen : 100mmx100mm
- Speed : 50mm/min
- Width: 10mm

Test Apparatus



Peeling test results

※ Unit : N/cm

LG Chem	MP5000AM	3.1
	MP5000AMK	5.2
	MP5000AMD	4.0
	MP5000AT	7.3
Competition	A	2.7
	B	3.5

EP materials

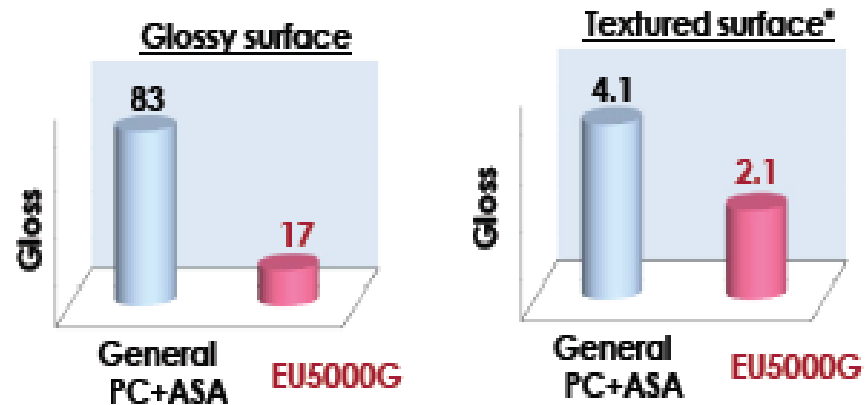
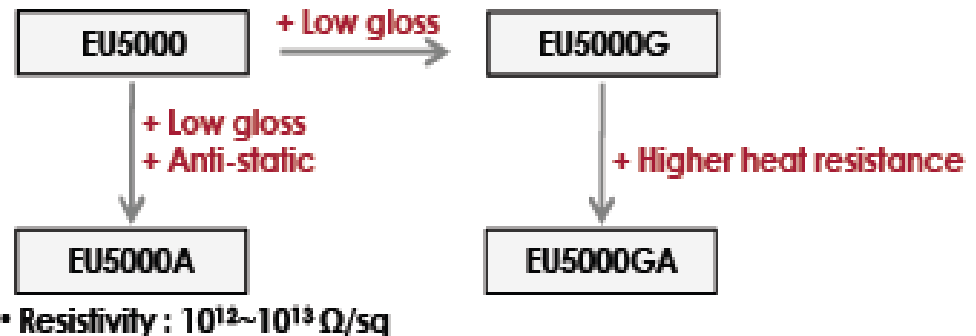
PC/ASA

Overhead Console

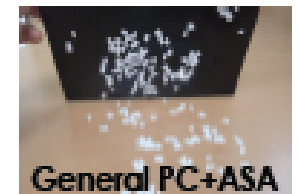


LUPOY EU5000 etc.
(PC+ASA)

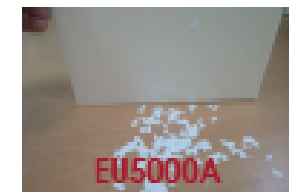
✓ Basically good UV stability, adding extra characteristics.



Anti-static properties



General PC+ASA



EU5000A

* Mold temp. 80°C, Measurement angle 60°, Textured surface for Hyundai

PC/ASA product portfolio

Interior Application

General

- EU5000

Low Gloss

- EU5000G
- EU5000GA



Exterior Application

Weatherability

- EU5000W
- EU5002W



Properties (ASTM)		EU5000	EU5000G	EU5000GA
Specific Gravity		1.14	1.16	1.17
MI (250°C/2.16Kg)		6.0g/10min	5.0g/10min	4.4g/10min
Izod Impact (Notched)	23°C	50Kg·cm/cm	25Kg·cm/cm	35Kg·cm/cm
	-30°C	15Kg·cm/cm	10.5Kg·cm/cm	12Kg·cm/cm
HDT (18.6kg, Edgewise)		109°C	112°C	118°C
Gloss(45°)		94	7.6	7.6
Application		Auto Interior	Over Head Console Room Lamp Housing	
Comment		PC/ASA	Low Gloss PC/ASA	

Properties (ISO)		EU5000W	EU5002W
OEM SPEC		FCA (MSDB19 CPN3606)	Volvo (STD 411-0001)
Specific Gravity		1.13	1.14
MI (260°C/5Kg)		16.3 g/10min	18.2 g/10min
Charpy Impact (Notched)	23°C	40KJ/m ²	50KJ/m ²
	-40°C	10KJ/m ²	13KJ/m ²
HDT (1.8MPa, Flatwise)		98°C	100°C
Weatherability		ΔE = 2.5 (2500KJ/m ² , MS-JP-9-5)	Grey Scale 4~5 (500hr, ISO 4892-2)
Application		Roof Rack Cover, Rear Spoiler, Truck Sunvisor, Etc	
Comment		Charpy Impact >75% after Thermal aging(90°C, 1,000hrs)	



Thank you



LG Chem Poland Sp. z o.o.