LG Chem

Leading with Science for Sustainability

LG Chem

We ConnectScience





LG Chem's Sustainability Strategy

We ConnectScience

O1 LG Chem Introduction
O2 Sustainable Product Portfolio

Mechanical Recycle
Chemical Recycle
Bio Based
Bio Mass Balanced

03 Global Plant Location

04 Wrap-Up

LG Chem | Business Area

Business units



Advanced Materials



Petrochemicals

Financial Result



- Engineering Material
 RO Filter
- Battery Material
- Semiconductor Materials

• CNT

• ABS

Acrylates/SAP

• HPM

- IT Material
- NCC
- Polyolefins
- PVC/Plasticizers
 Catalyst

θÅ

Life Science

- Primary Care
- Specialty Care
- Aesthetic

37.3



Sustainability

LG Chem's sustainable strategy

LG Chem call to action includes aggressive carbon reduction, increased green energy and circular resource system



Overview of LG Chem's Sustainable Portfolio

Engineering Materials division adopted 4 technologies as future promising technologies in sustainability perspective.

FOverview



Product Line

1 Mechanical Recycle	2 Chemical Recycle	Bio-based	4 Bio-mass Balanced	5 Biodegradable
 PC, PC/ABS, PA66 OBP PA6, PET * OBP : Ocean Bound Plastic 	 PC, PC/ABS PBT, TPEE Pyrolysis 43K MT(~'24) 	 PA56 (Replaceable of PA66) PBT, TPEE 	• PC, PC/ABS	• PLA - 75K MT(~'25) • PBAT - 50K MT(~'24), 100K MT(~'27)

LG Chem | Eco-friendly Brand

LETZer

Eco-friendly Material Brand LETZero

A compound word of "Let" and "Zero," which means "to turn harmful substances to the environment and the net increase in carbon emissions into zero."

LETZero Product Line





LETZero Certification

1원회 고시에 의 ETZer

LETZero Product Package

Mechanical Recycle



Mechanical Recycle



Fenhanced Quality Control



Long-Term Reliability

PCR product shows similar tendency as virgin product for long-term reliability test (120°C, 1,000 hrs)





Mechanical Recycle

LG Chem provides a new color solution experience through advanced coloring technology with rapid and accurate color development.

Color Development

Black	Grey			White	Transparent
 Speed Average of 5.6 days for c	color development	Accuracy	Less than <mark>7%</mark> of re-c	oloring until approval	

Special color



Application Examples



1		on								
	Notebook	AI Speaker	Set Top Box	Adaptor	Interior Parts	Trim Parts	AVN* Audio Video Navigation	Mobile Phone Case	Metering	Bus Shelter
	Grade LUPOY ER2403FT	LUPOY ER5001RFZ	LUPOY ER1000Y	LUPOY ER1006FNA	LUPOY ER5006N/ 6NC/7N	LUPOY ER5100N, 5200A, 5300A	LUPOY ER1000MU	LUPOY ER1004A	LUPOY ER2101F	LUPOY ER1000MH
C	PCR 30% GF40% V-0 @ 0.8 mm	PCR 60%, V-0 @ 1.2 mm	PCR 90%, IR Transmission	PCR 50%, V-0 @ 0.8 mm	PCR 50%, Painting	PCR 30 ~ 50%, GF 10 ~ 30% Reinforced	PCR 50%	PCR 50%, Impact Modified	PCR 60%, GF 10% V-0 @ 1.2 mm	PCR 60%, Transparent, Extrusion

Applicable Parts in Laptop



sification	Grade	PCR Contents(%)	Description
Current	GN2403FT	0	
Current	ER2403FT	30	FR PC GF 40% V-0 @ 0.8mm
New	ER2403FN	45	C
Current	GN5101RF	0	FR PC/ABS MF5%,
New	ER5101RFN	50	V-0 @ 0.75mm
Current	GN5254FW	0	FR PC/ABS MF25%
Current	ER5254F	30	V-0 @ 1.0mm
Now	ER5254FW	35	FR PC MF25%
New	ER5254FN	50	V-0 @ 1.2mm
Current	GN5151RFA	0	
	ER5151RFL	30	FR PC/ABS MF15%,
New	ER5151RFN	50	V-0 @ 1.2mm
OBP	ER5151RFO	PCR45+OBP5	
Current	GN1008RF	0	
Current	ER1008RF	30	FR PC, V-0 @ 0.6mm
Now	ER1008RFN	50	
New	ER1007FX	85	FR PC, V-0 @ 0.8mm
Current	ER1006FD	30	
Now	ER1006FNA	50	FR PC, V-0 @ 1.0mm
New	ER1006FY	90	
Current	-	0	MABS
New	ER1000Z	75	Transparent PC
	sification Current Current Current Current Current Current OBP Current Current New Current New	dificationGradeCurrentGN2403FTER2403FNER2403FNCurrentGN5101RFCurrentGN5101RFNCurrentGN5254FWCurrentER5254FPressectionER5254FNCurrentGN5151RFACurrentGN5151RFNCurrentGN5151RFNCurrentER5151RFNCurrentGN1008RFCurrentER1008RFNCurrentER1008RFNCurrentER1006FNACurrentER1006FNACurrent-Mew-Current-MewFR1006FNACurrent-Current<	GradePCR Contents(%)CurrentGN2403FT0CurrentER2403FN30NewER2403FN45CurrentGN5101RF0NewER5101RFN50CurrentGN5254FW0CurrentER5254F30MewER5254FN30CurrentGN5151RFA0CurrentGN5151RFA0CurrentGN5151RFA30CurrentGN1008RF30OBPER5151RFN50CurrentGN1008RF0CurrentER1008RFN30CurrentER1008FFN30CurrentER1006FNA30CurrentER1006FNA50CurrentCurrent-<

Applicable Parts in Automotive





PCR Portfolio - PC

		Recycled Type	Virgin Type	Description	Application	
		ER1000D/MA	GP1000M	PCR 50%, Transparent		
		ER1000MH	-	PCR 60%, Transparent, Extrusion	Transparent Sheet	
		ER1000ML	-	PCR 50%, High Flow, Transparent V1 @3.0mm	Phone CaseKevcap	
		ER1000Z	GP1000L	PCR 75%, Transparent	Remote Controller Settophox	
		ER1000Y	-	PCR 90%, Transparent	· Settopbox	
Non-Reinforced		ER1004A/N	SC1004A	PCR 30%/50%, IM ¹⁾		
<u>РС</u> Сотр.		ER1006FH/FD/FN		PCR 20%/30%/50%. V0 @ 1.0 mm. RTI 125 ℃		
		ER1006FZ/FX/FY	EF1006F	PCR 75%/85%/90%, V0 @ 1.0 mm, RTI 125 ℃	 Charger Outdoor CCTV 	
	FR -	ER1006FU		PCR 50%. VO @ 1.5 mm. F1(Weatherability)	 IoT Devise 	
		ER1007FA/FZ	SF1007F	PCR 30%/60%, High Flow, IM, V0 @ 0.8 mm	Battery CaseTablet B/Cover	
		ER1008RF/RFN	GN1008RF	PCR 35%/50%, IM, V0 @ 0.6 mm		
				·		
					(
	Non-FR	ER2T02N	GP2102	GF 9% + PCR 50%		
		ER2101F		GF 10% + PCR 60%, V0 @ 1.5mm		
		ER2103FN	-	GF 10% + PCR 55%, V0 @ 0.8 mm		
Reinforced		ER2109FD	GN2109FD	GF 10% + PCR 50%, V0 @ 1.5 mm		
<u>PC</u> Comp.		ER2201F	GN2201FM	GF 20% + PCR 30%, V0 @ 1.5 mm	Action CameraTablet Bezel	
	FR -	ER2203FN	-	GF 20% + PCR 50%, V0 @ 0.8 mm	Laptop Cover	
		ER2253F	GN2253F	GF 25% + PCR 30%, V0 @ 0.8 mm		
		ER2303F]	GF 30% + PCR 30%, V0 @ 0.8 mm		
		ER2303F ER2403FT	- GN2403FT	GF 30% + PCR 30%, V0 @ 0.8 mm GF 40% + PCR 30%, V0 @ 0.8 mm		



PCR Portfolio – PC/ABS, PC/ASA, OBP

		Recycled Type	Virgin Type	Description	Application		
		ER5002N	HI5002A	PCR 50%, Low Heat			
	Nex ED	ER5006N	HR5006A	PCR 50%, Medium Heat	Auto Interior/Exterior		
		ER5006NC	HR5007A	PCR 50%, Medium high Heat	Accessory		
Non-Reinforced		ER5007N	HR5007AC	PCR 50%, High Heat			
<u>PC/ABS</u> Comp.	- 	ER5000SFC	GN5000SFC	PCR 30% V0 @1.5mm, High Flow			
		ER5001RF		PCR 30%, V0 @ 1.5 mm, RTI 180 °C			
	ER -	ER5001RFK	GN5001RF	PCR 30%, V0 @ 1.2 mm	IoT Device		
		ER5001RFZ		PCR 60%, V0 @ 1.2 mm	Laptop BezelE&E Housing		
		ER5001RFA	GN5001RFA	PCR 30%, V0 @ 1.2 mm	Office Appliance		
Non Deinforred		ER5001RFH	GN5001RFH	PCR 60%, V0 @ 1.5 mm, RTI 80 °C			
	FR	ER5000FS EU5000FS PC		PCR 50%, V0 @1.5mm, F1			
<u>- c///o//</u> comp.							
		ER5100N	GP5100	GF 10% + PCR 50%			
Γ	Non-FR	ER5200A	GP5200	GF 20% + PCR 30%	Auto Interior		
		ER5300A	GP5300	GF 30% + PCR 30%	[]		
Reinforced	Г	ER5101RFN	-	MF 5% + PCR 50%, V0 @ 0.75 mm	(
<u></u> b.		ER5151RFL		MF 15% + PCR 30%, V0 @ 1.2 mm			
	FR	ER5151RFN	GNSTSTRFA	MF 15% + PCR 50%, V0 @ 1.2 mm	IoT Device		
		ER5254FW		MF 25% + PCR 30%, V0 @ 1.0 mm	Laptop Bezel		
	L	ER5254FN	GINDZD4FVV	MF 25% + PCR 35%, V0 @ 1.2 mm	E&E Housing		
Ocean Bound	— FR —	ER5101RFO	-	MF 5% + PCR 45% + OBP 5%, V0 @ 0.8 mm			
Plastic		ER5151RFO	RFO GN5151RFA MF 15% + PCR 45% + OBP 5%, VC				

Life Cycle Assessment(LCA)

LG Chem provides LCA report to calculate reduction of carbon footprint when using LG Chem's sustainable materials



• All other indirect emissions from activities

of the organization

Scope 3





Source : GHG Protocol

Environmental Benefit

PCR PC 50% PC/ABS



CO₂Emission



Water Consumption

-30%

Cumulative Energy Demand

-30%

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LCA Report (PCR vs Virgin)



	3 • • • • •	
Acidification	kg SO2 eq.	1.13E-02
Ozone depletion	kg CFC11 eq.	2.94E -0 7
H2O depletion	m3 H2O eq.	2.38E-02
Eutrophication	kg PO43- eq.	1.46E-03
Photochemical oxidation creation	kg ethylene eq.	7.97E-04
Abiotic Resource depletion	kg Sb eq.	1.68E-02

Life Cycle Assessment Background Information

1. Functional Unit

To produce 1kg of polycarbonate (PC) based compound, in Korea, in the year of 2020

2. System Boundary

Cradle to Gate (excluding environmental burden of the first cycle of recycled materials)

3. Characterization Method

CML 2001 (Climate Change, Acidification, Ozone depletion, Eutrophication, Photochemical oxidation creation, Abiotic Resource depletion) ReCipe 1.08 Midpoint (Water depletion)

4. Data Source

- Upstream: On-site data were collected for recycled materials, secondary data being utilized for the other materials.
- Manufacturing: On-site data were collected.
- Downstream: Not applicable

5. Data quality and Sensitivity

6. Allocation

Since raw materials, utilities, energy consumptions, and wastes in the process are not separately managed between the product and byproducts, an allocation according to the production weight ratio was considered. As for a by-product which reuses internally, it was considered as a close loop.







LCA Results report

Target product LUPOY HR5007AC (1 kg) Data collection period - 2020.01.01 ~ 2020.12.31 Standard

According to ISO 14040 & 14044

Life Cycle Assessment Results

Impat Category	Unit	Quantities
Climate Change	kg CO2 eq.	3.60E+00
Acidification	kg SO2 eq.	2.43E-02
Ozone depletion	kg CFC11 eq.	8.91E-07
H2O depletion	m3 H2O eq.	4.05E-02
Eutrophication	kg PO43- eq.	3.54E-03
Photochemical oxidation creation	kg ethylene eq.	1.03E-03
Abiotic Resource depletion	kg Sb eq.	3.49E-02

Life Cycle Assessment Background Information

1. Functional Unit

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Ocean Bound Plastic(OBP)

Ocean bound plastics like water bottle and fishing net are transformed to a valuable sources



2) Certification of the amount of OBP you have prevented supports your environmental claims and ESG certifications and rating.

Ocean Bound Plastic(PET)

LUPOY ER5151RFO(PC/ABS/PET-MF15)

Test Class		Test Method	Test Condition Unit		LUPOY GN5151RFA (Virgin)	LUPOY ER5151RFN (PCR 50%)	LUPOY ER5151RFO (PCR 45% + OBP 5%)	
Flow/Physical	Melt Index	ASTM D792	g/10min	250℃/2.16Kg	10	9	6	
	Spiral (Temp. : 270℃ / 60℃)	LG Method	cm	Thick. 1.5 mm	30	29	28	
	Mold Shrinkage	ASTM D955	%	3.2 mm	0.2-0.4	0.2-0.4	0.2-0.4	
	Tensile Strength at Yield	ASTM D638	Kg/cm2	50mm/min	690	680	690	
Machanical	Flexural Strength, 3.2mm		Kg/cm2	10mm/min	1,100	1,000	1,100	
Mechanical	Flexural Modulus, 3.2mm	ASTIN D790			43,000	43,000	42,000	
	Izod Impact Strength	Izod Impact Strength ASTM D256		23℃ @3.2T	6.0	7.0	7.3	
Thermal	HDT	ASTM D648	Ŷ	18.6kgf	91	91	88	
	Flammability	UL 94	C .	@ 1.2mm	V-0	V-0	V-0	

Note) Typical values are only for material selection purpose, and variation within normal tolerances are for various colors.

Values given should not be interpreted as specification and not be used for part or tool design.

Ocean Bound Plastic(PA6)

PA6-GF 30 ~ 50%

Test Class		Test Mathad	11-:+	Test Condition	GF 30%		GF 40%		GF 50%	
			Unit		Virgin	OBP	Virgin	OBP	Virgin	OBP
	Specific gravity	ISO 1183	-	-	1.35	1.36	1.45	1.46	1.57	1.57
Flow/Physical	Mold Shrinkage	150 204	1/1000	Transverse	5.45	5.53	5.34	5.50	5.15	5.12
	2.0mm	150 294		Parallel	2.00	1.92	1.54	2.14	2.58	1.93
	Tensile Strength	- ISO 527	MPa	5 mm/min	185	170	210	195	245	215
	Tensile Elongation		%		3.5	3.2	3.0	2.9	2.7	2.7
Machanical	Flexural Strength	150 170	MPa	2 mm/min	270	260	330	300	375	335
Wethanical	Flexural Modulus	130 178	MPa		8200	8200	11400	11300	15000	15000
	Charpy Impact	ISO 179/1eA	kJ/m2	Notched, 23℃	13.0	10.5	19.0	14.0	22.0	16.0
	Strength	ISO 179/1eA	kJ/m2	Unnotched, 23℃	88	75	95	90	N.B	89
Thermal	Heat Deflection Temp	ISO 75	C	1.80 MPa	211	206	215	211	217	214

Note) Typical values are only for material selection purpose, and variation within normal tolerances are for various colors.

Values given should not be interpreted as specification and not be used for part or tool design.

Chemical Recycle

It is an upcycle process which aims to convert heavily contaminated plastic waste into its monomer stage(pre-cursor) through depolymerization/dissolution technology





Bio-Based

Main benefits of bio-based product is that it is an option for phasing out from fossil fuel, it can be used as a good marketing tool. Also since the production is starting from the monomer stage, after polymerization it is considered as virgin like quality.



Bio-Mass Balanced

Main benefit of bio-mass balanced are it can reach virgin like quality since we are using same production process same as the existing petrochemical production. Also for polycarbonate there is no other bio option than bio-mass balanced so it is a good alternative option



Global Location

LG Chem can globally supply equal quality of PCR products to customers



WeConnectScience

Thank you

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