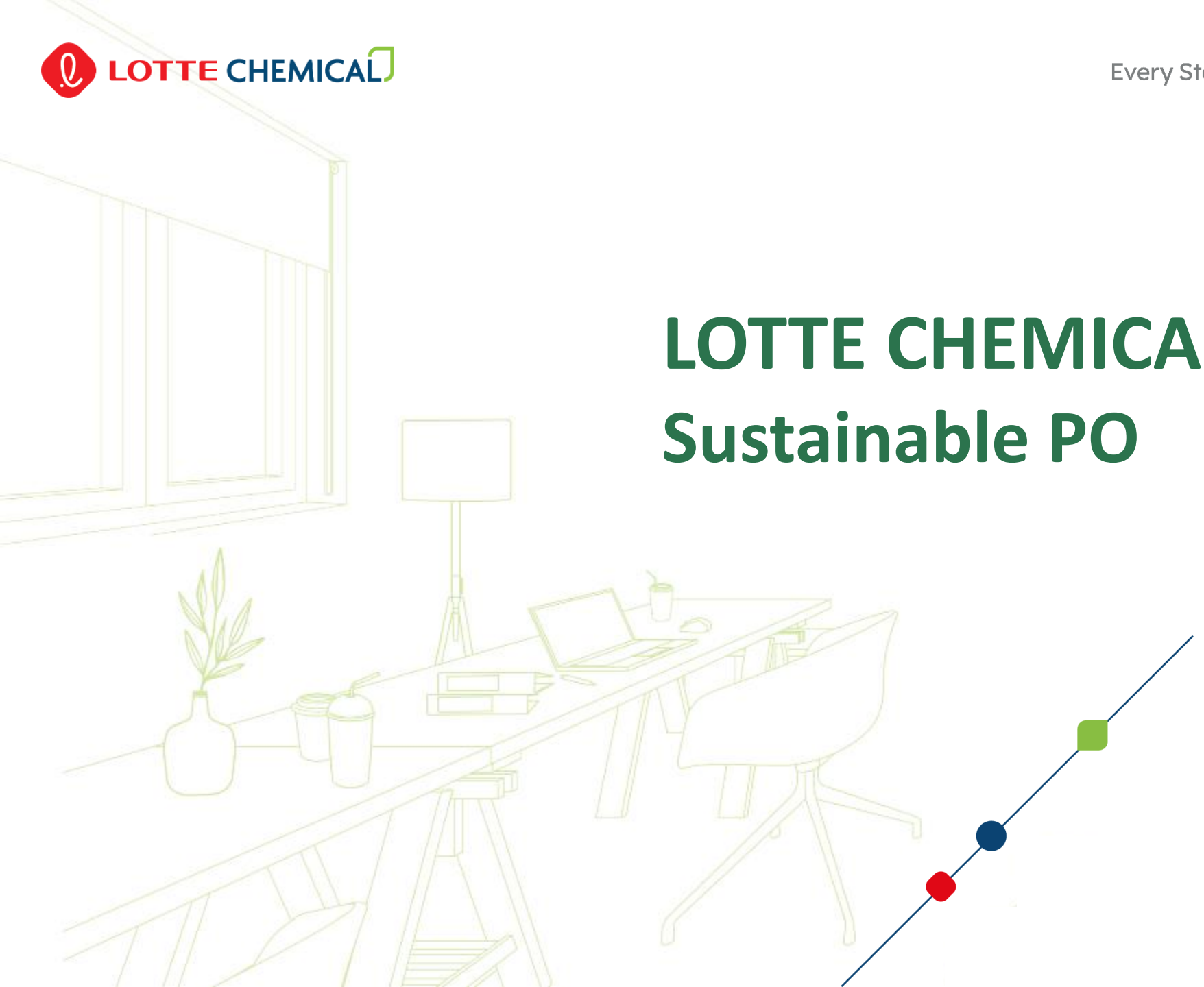
LOTTE CHEMICAL

Every Step for GREEN

LOTTE CHEMICAL
Sustainable PO



We Lead Every Step for a Greener and Better Tomorrow

Every Step for GREEN

People Oriented

Value toward people –
stability and harmony

Forward Thinking

Start of innovation –
products and technology

Life Enriching

Abundant life
and sustainable future

GREEN PROMISE 2030

Net - Zero

Carbon neutral and
eco-management

Circulation and Coexistence

creation of circulating/coexisting
social values

Green Innovation

Leading sustainable
future industries

Sustainable PO

Recyclable

Mono-material (BOPE/BOPP)
Water Floating Shrinkage Label

Recycle

Mechanical
Chemical
Bio-based

Reduce

Light-Weight HMSPP

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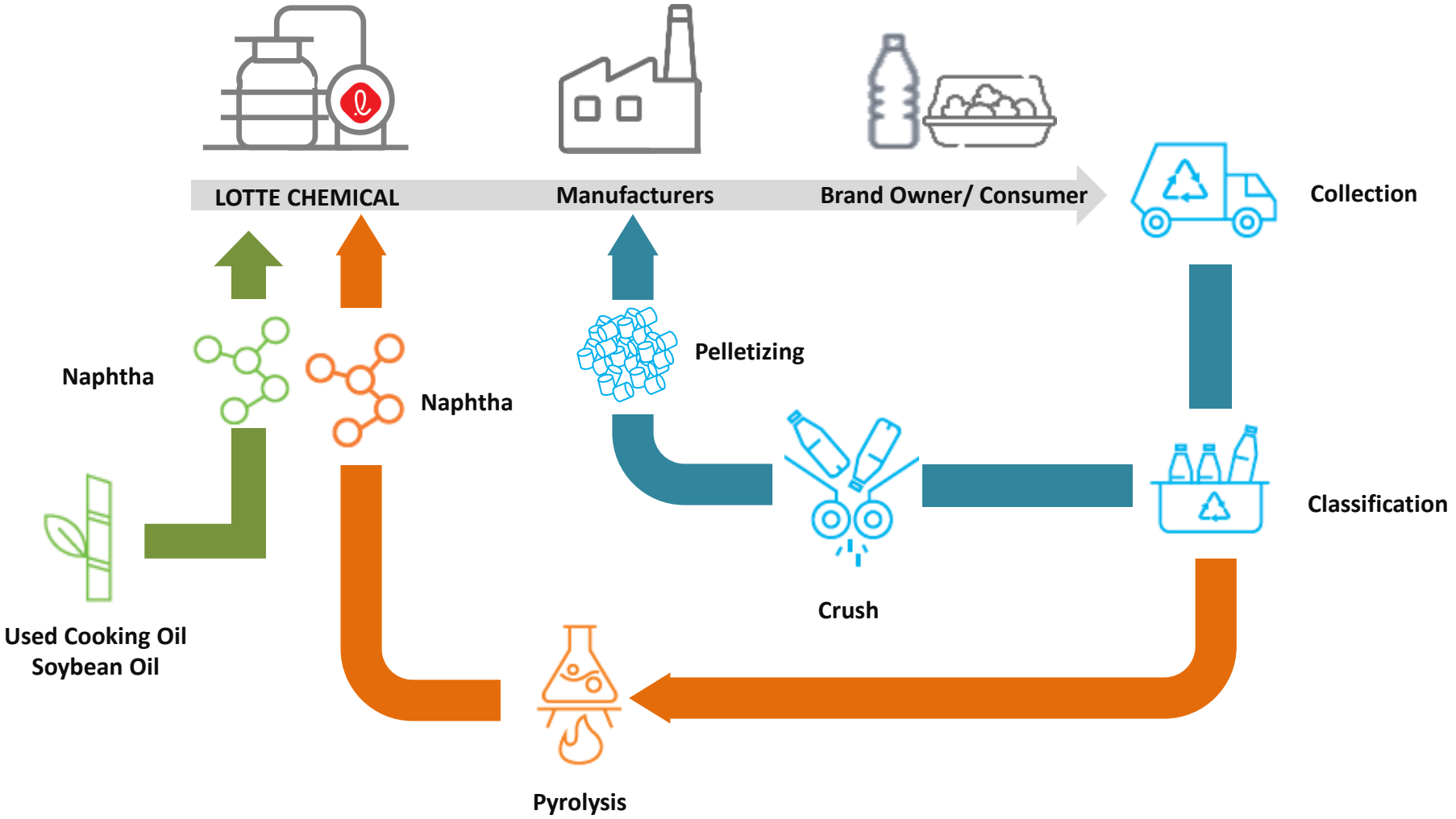
Recycle

✓ Value chain Collaboration



Recycle

✓ Recycling PO

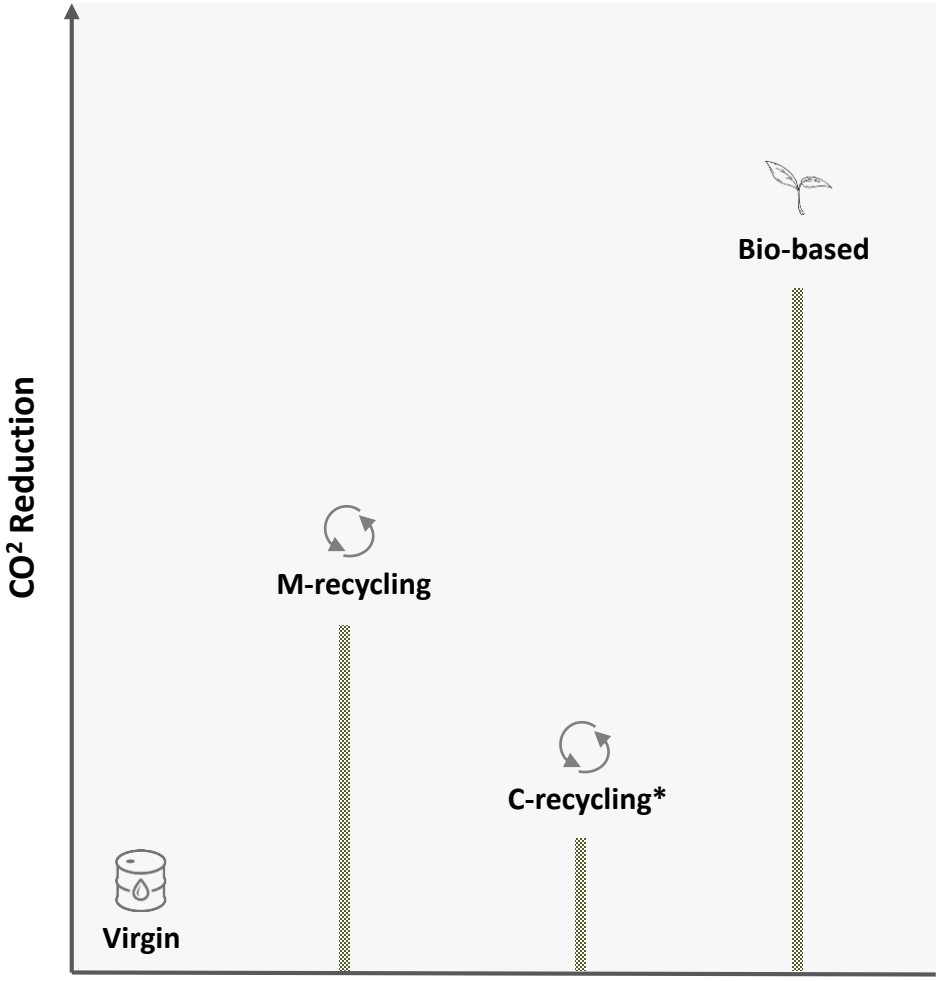
Mechanical

- **GRS certification**
- **Feedstock: PCR**
- **Product portfolio**
  - ✓ **PP inj., sheet, blow** (w/ FDA NOL)
  - ✓ **HDPE blow**
- **Application**
  - ✓ **Cosmetics, Healthcare, House holds, Mobility etc.**

Chemical / Bio

- **ISCC PLUS certification** (Mass balance approach)
- **Feedstock: PCR** (Circular)**, UCO*** (Bio-circular)**, Soybean Oil** (Bio)
- **Product portfolio**
  - ✓ **PP, HDPE, LLDPE, EVA etc. (All grades)**
- **Application**
  - ✓ **Food & beverage, Hygiene, Healthcare etc.**

* UCO: Used Cooking Oil



* C-recycling: Considering the incineration avoidance effect

Recycle

✓ Mechanical recycling PO

Item	Unit	PP								PE
		PCR-0352	PCR-0552	PCR-0752	PCR-0762	PCR-0952	PCR-0052	PCR-0321D	PCR-0321E	PCR-1511F
Application		Injection Molding						Sheet/IBM		DBM
PCR content	%	30	50	70	70	90	100	30	30	50
Color	-	White	White	White	White	White	White	White	White	White
MI	g/10min	17	16	15	24	11	9	1.3	2.0	0.29
Tensile Strength	kg_f/cm^2	305	310	320	320	325	328	320	315	290
Elongation	%	>500	>400	>400	>300	>400	>400	>400	>400	>400
Flexural Modulus	kg_f/cm^2	12,500	12,700	12,900	12,750	13,000	13,100	14,200	14,100	12,100
Izod Impact Strength (23℃)	kg_f·cm/cm	4.0	4.2	4.3	4.7	4.5	4.5	60	50	25
HDT (4.6kgf/cm^2)	℃	105	110	113	110	115	117	124	128	-
FDA/RoHS		O	O	O	O	O	O	O	O	O
FDA NOL		O	O	O	O	O	Be scheduled	O	O	Be scheduled
GRS		O	O	O	O	O	O	O	O	O

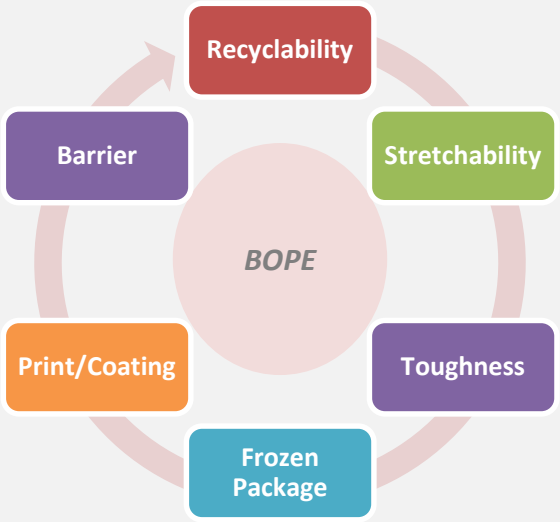
Recyclable

✓ BOPE for PE Uni-material Film

Replace

Nylon/PET → BOPE

- An item used to printing or sealant substrate with easy to recycle and downgauging
- Uni-material(All PE) - Printable, Impact resistance, Moisture barrier



❖ Multi-material VS. Full PE structure

	Multi-material	PE Mono-material
Film Properties		
Total thickness(㎛)	100	100
Recyclable	X	O
OTR(cc/m²·day)	53	2
WVTR (g/m²·day)	3.9	3.2
Application		


Dry Food

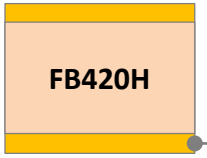

Frozen Food


Duty Sack Bag

Recyclable

✓ Solution for PE Uni-material Film

- Conventional BOPP Line



- Multi-layer Film Design
- BOPP Line can be utilized

- BOPE/BOPP Hybrid Line

- Satisfaction of Processability
- Good Balance with Clarity and Thermal Stability

Properties	Test Method	Unit	FB420H	FB420S
Physical				
MI (2.16kg, 190℃)	ASTM D1238	g/10min	1.1	1.8
Density	ASTM D1505	g/㎤	0.951	0.945
MWD	LCC Method	-	15~20	
Thermal				
Melting Point	ASTM D3418	℃	129	128
BOPE Film (Stretching ratio MD 5 x TD 9)[1)]				
Tensile Strength(MD)	ASTM D882	MPa	80	70
Heat Shrinkage(100℃, 5min)	ASTM D1204	%	<3	<3
Haze	ASTM D1003	%	30 / 8(w/ skin)	10

1) Film Properties : these are not to be construed as specifications (Measured on 30μm 3-layer BOPE film)

Recyclable

✓ BOPP&CPP for PP Uni-material Film

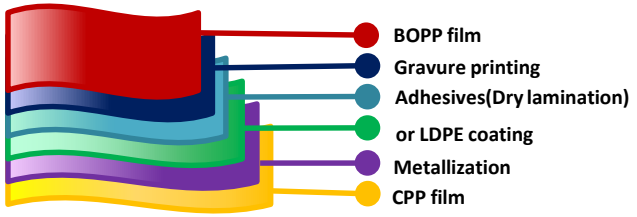
Replace

Nylon/PET → BOPP

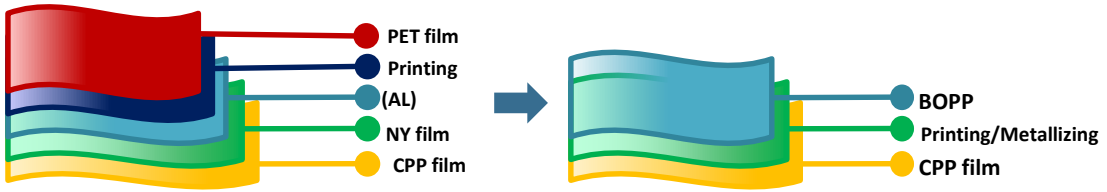
CPP → Impact Enhanced CPP

- All-PP Uni-material (Recyclable)
  - Emerging recyclability regulation in each countries
  ex) Grade A should be higher or equal to 95% by weight (EU)
- Plastics Usage Reduction
  (10% Reduction compared to PET by density)

❖ **General component of Packing Film**



❖ **General component of Pouch film**

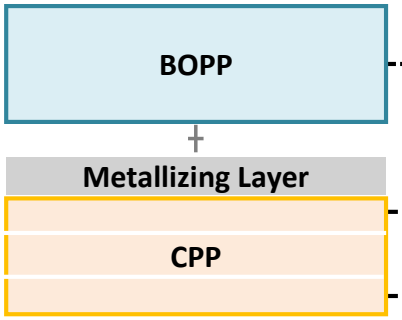


- **Barrier property in Pouch film**
- **NY film**
  - Anti-pinhole property
  - Impact strength
- **PET film**
  - Stiffness
  - Heat resistance

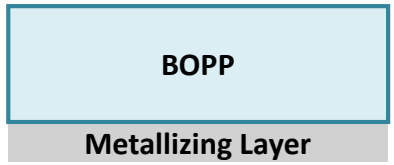
- **Barrier property with metallizing or coating (SiOx, ALOx)**
- **Enhanced impact strength in CPP film**
  - High impact strength film (RTPO)
  - can be adjusted with thickness
- **Enhanced stiffness & heat resistance in OPP film**

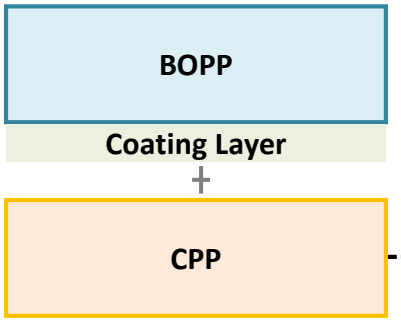
Recyclable

✓ Solution for PP Uni-material Film



<General Film>





<Pouch Film>

Grade	MI (g/10min, 230℃)	Flexural Modulus (kgf/cm²)	Property
FO-135A	3	15,000	High speed Suitable for Metallizing film

Grade	MI (g/10min, 230℃)	Flexural Modulus (kgf/cm²)	Property
SFC-650BT	8	10,500	Metallizing film skin layer High aluminum bonding

Grade	MI (g/10min, 230℃)	Heat sealing temp. (℃)	Property
SFC-751M	7	118	Metallizing film seal layer Low heat seal temperature
SFC-752M (Developing)	7	116	

Grade	MI (g/10min, 230℃)	Xylene Soluble (%)	Property
FC-330S	2.8	10	Impact copolymer film grade Good impact strength Retort Pouch CPP film application
FC-335R	2.8	15	
FC-340R	5	10	
(Developing)	3-5	20-30	

Recyclable

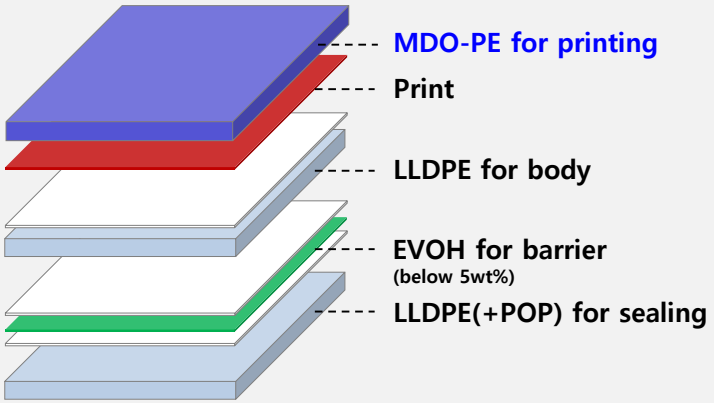
[MDOPE]

✓ MDO(Machine Direction Oriented) PE for Mono-material Packaging

Replace

Printable material : PET → MDO-PE

- MDO-PE is designed as a new packaging solution to replace multilayer films containing PET films, which are difficult to recycle.
- MDO-PE film is designed for printing layer.



❖ Advantages

- Wider sealing operation window from high heat resistance
- Better printability from high stiffness
- Extra moisture barrier can be achieved via MDO with EVOH layer
- High clarity with haze < 12%

❖ Technical data sheet of FL3200

Item		Measuring Method	Unit	Value
Physical				
Melt Flow Index		ASTM D1238	g/10min	0.80
Density		ASTM D1505	g/㎤	0.963
Mechanical				
Tensile Stress (Yield)		ASTM D638	kgf/㎠	290
Tensile Strain (Break)		ASTM D638	%	≥500
Flexural Modulus		ASTM D790	kgf/㎠	13,000
Rockwell Hardness		ASTM D785	R	60
Films (50㎛)				
Secant Modulus (1%)	MD	ASTM D882	MPa	950
	TD	ASTM D882	MPa	1,100
Haze		ASTM D1003	%	43
Thermal				
VICAT Softening Temperature		ASTM D1525	℃	130

Technical data : these are not to be construed as specifications.

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Recyclable

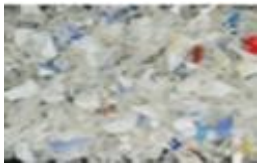
✓ Water Floating Shrinkage Label

: Separation in the water by difference in density between PO label and PET bottle

→ We can obtain "High quality r-PET resin"

Cap & closure : PE, PP

Bottle: PET

Label: OPP → Adhesive →  Low quality r-PET

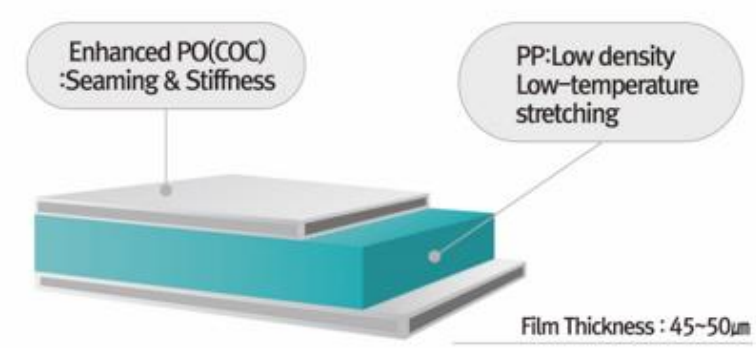
Label: OPS / PET → Impossible to water-separation →  Low quality r-PET

Label: Polyolefin → Water Floating →  High quality r-PET

Recyclable

✓ Water Floating Shrinkage Label

- **Multi-layer structure**
  - **Outer: COC[1)]**
  - **Inner: PP SF-542H**



1) Cyclic Olefin Copolymer

Item		Unit	SF-542H
General Analysis	Melt flow Index	g/10min	8.0
	Density	g/㎤	0.9
Mechanical Properties	Tensile strength at Yield	kgf/㎠	160
	Elongation at Break	%	>500
	Flexural modulus	kgf/㎠	4,400
	HDT(4.6kgf/cm²)	℃	60
Thermal Properties	Melting Temperature	℃	128
Additives	Phosphorus Antioxidant	-	●
	Phenol Antioxidant	-	●
	Slip agent	-	-
	Anti-blocking agent	-	-
Film Properties[1)] (50㎛)	Density	g/㎤	0.92
	Haze	%	<2.0
	Loop Stiffness	gf/50㎛	6.0
	TD Shrinkage at 100℃	%	>50

1) Film Properties : these are not to be construed as specifications

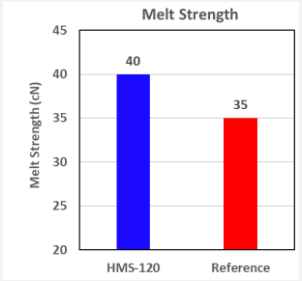
Reduce

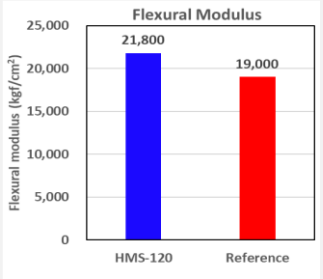
✓ HMSPP (High Melt Strength Polypropylene)

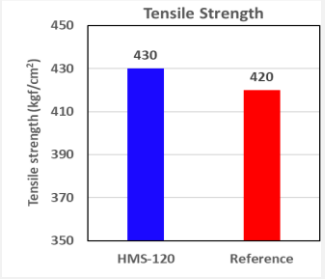
- features enhanced melt strength achieved by introducing long chain branches (LCB) to polypropylene (PP).
- During the stretching process in the molten state, strain hardening occurs due to the chain entanglement of the side branches, resulting in improved foam processability.
- Application: Food Container, Construction, Automotive, etc

Reduce

PP Solid → PP Foam







Free EDCs, Easy to Recycle, Reduce Plastic Consumption, Heat Resistance, Insulation

Item	Unit	HMS-130
MI (230℃, 2.16kg)	g/10min	2.0
Density	g/㎤	0.90
Tensile Stress (Yield)	kgf/㎠	410
Tensile Strain (Break)	%	< 100
Izod Impact Strength (notched, 23℃)	kgf·㎝/㎝	8.8
Izod Impact Strength (notched, -10℃)	kgf·㎝/㎝	2.3
Heat Deflection Temperature (4.6kgf/㎠)	℃	135
Melt Strength	cN	36
Melt Extensibility	mm/sec	230

* Physical Properties : these are not to be construed as specifications