

長  春

Chang Chun PBT / TPEE Introduction

2015.05.19

Agenda

- 1. CCP Group Overview**
- 2. CCP PBT Introduction**
- 3. CCP TPEE Introduction**
- 4. Discussions**



ChangChun
Group

CCP Group Overview

- Initial Company :

Chang Chun Plastics Co., Ltd.

(Founded in 1949, Capital: 50USD)



- Other main affiliates in CCP Group

Chang Chun Petrochemical Co., Ltd.

Dairen Chemical Co., Ltd.

Taihong Circuit Ind. Co., Ltd.

- Founders :

M. K. Liao, Su Hon Lin, S. Y. Tseng

- Chairman: L.S.Liao

- Sales Revenue: 9.2 Bil. USD(2014)

- Employee: > 10,000 people

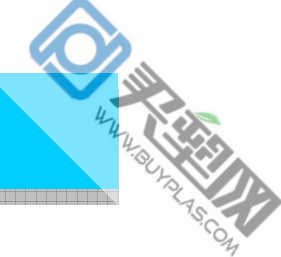


長春集團公司沿革

集團公司總數 Number of affiliate and subsidiary : 33

◆1949	長春人造樹脂廠	CHANG CHUN PLASTICS CO.,LTD.
◆1964	長春石油化學	CHANG CHUN PETROCHEMICAL CO.,LTD.
◆1969	台豐印刷電路工業	TAI HONG CIRCUIT INDUSTRY CO.,LTD.
◆1979	大連化學工業	DAIREN CHEMICAL CORPORATION
◆1988	住工股份有限公司	TSU KONG CO.,LTD.
◆1988	台灣工程塑膠	TAIWAN ENGINEERING PLASTICS CO. LTD.
◆1989	長江化學	CHANG CHIANG CHEMICAL CO.,LTD.
◆1990	三義化學	TRIPLEX CHEMICAL CORPORATION
◆1992	長春化工(印尼)	PT. CHANG CHUN DPN CHEMICAL INDUSTRY. (INDONESIA)
◆1994	吉林化工	JI LIN CHEMICALS CO., LTD.
◆1998	台灣住友培科	SUMITOMO BAKELITE (TAIWAN) CO.,LTD.
◆1998	大連化工(馬來西亞)	DAIREN CHEMICAL (M) SDN. BHD.
◆1999	台灣東應化	TOK TAIWAN
◆2000	長捷士科技	ROGERS CHANG CHUN TECHNOLOGY CO.,LTD.

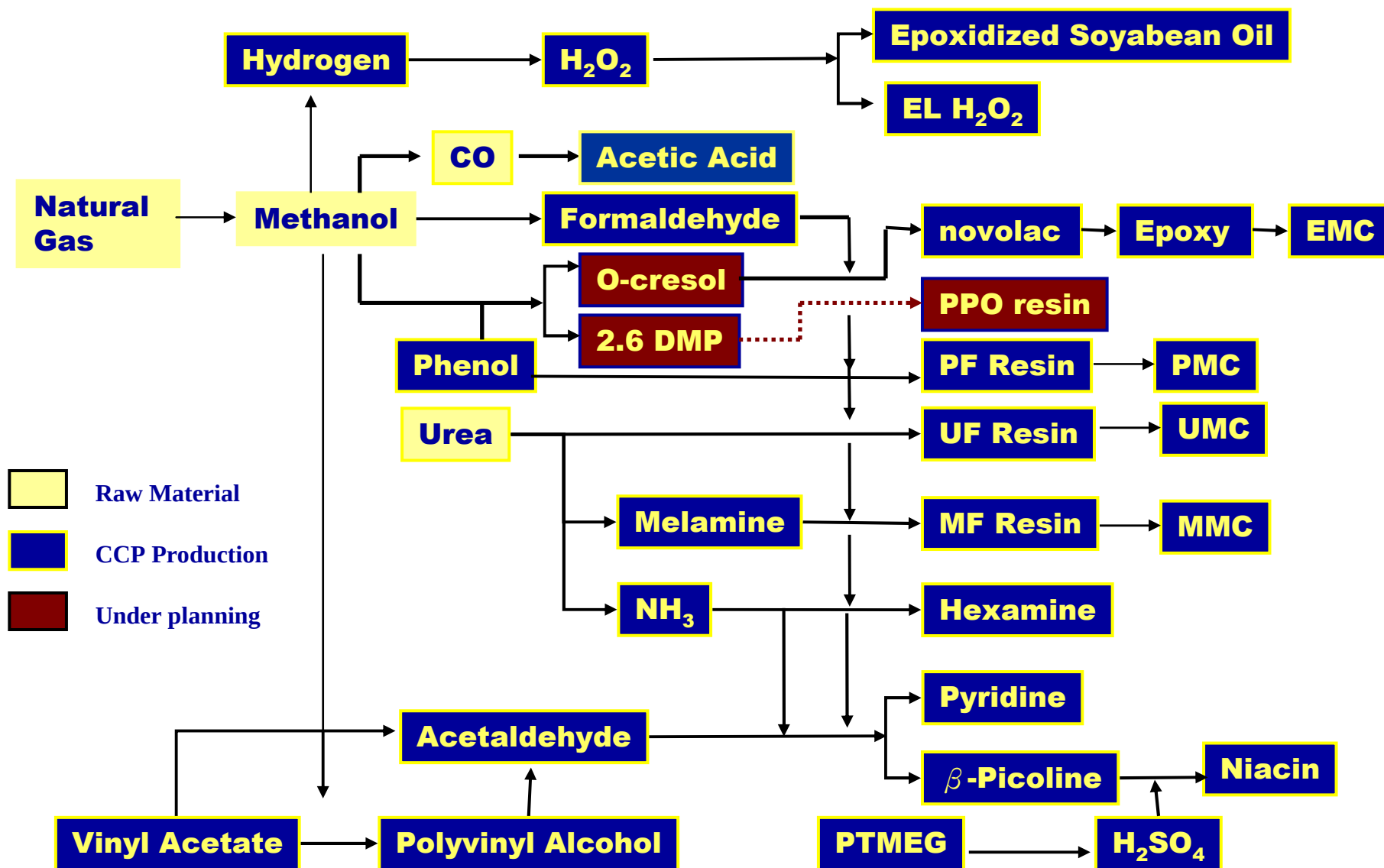
長春集團公司沿革



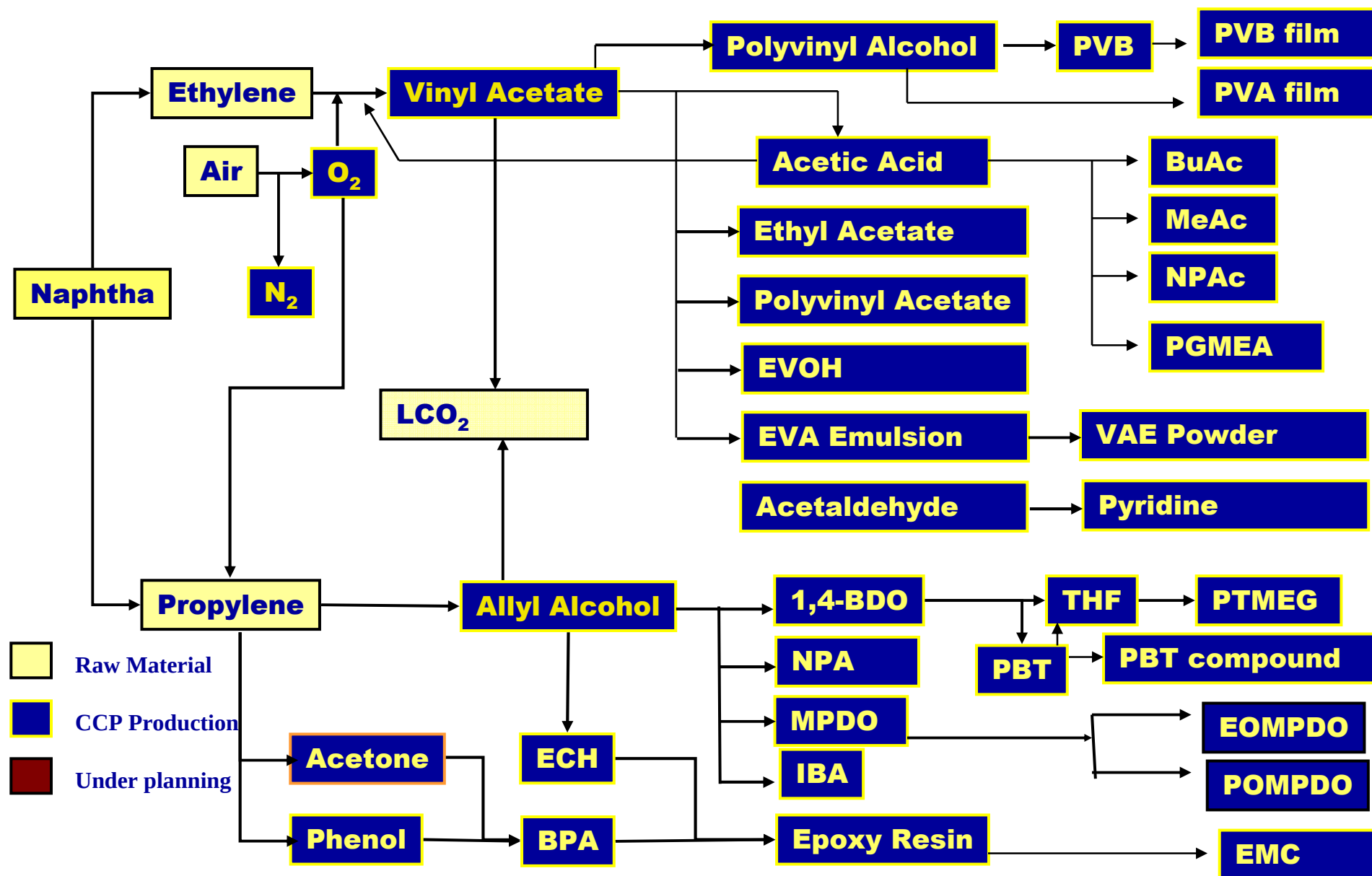
- ◆2002 長春化工(江蘇) CHANG CHUN CHEMICAL (JIANGSU) CO.,LTD.
- ◆2003 長春封塑料(常熟) CHANG CHUN SB (CHANGSHU) CO.,LTD.
- ◆2003 艾迪科精細化工 ADEKA FINE CHEMICAL (CHANGSHU) CO.,LTD.
- ◆2003 長連旭貿易(上海) CHANG CHIANG CHEMICAL (SHANGHAI) CO. ,LTD.
- ◆2003 長春化工(漳州) CHANG CHUN CHEMICAL (ZHANGZHOU) CO.,LTD.
- ◆2003 大連化工(江蘇) DAIREN CHEMICAL (JIANGSU) CO.,LTD.
- ◆2004 長龍化工(深圳) CHANG LONG CHEMICAL (SHENZHEN) CO.,LTD.
- ◆2004 長春日本株式會社 CHANG CHUN JAPAN CO.
- ◆2004 長春應化(常熟) CHANG CHUN TOK (CHANGSHU) CO. ,LTD.
- ◆2005 南非長春MERISOL CHANG CHUN MERISOL RSA (PTY) LTD. (South Africa)
- ◆2007 優必佳樹脂(常熟)有限公司 U-PICA RESIN (CHANGSHU) CO., LTD
- ◆2007 長龍化工(深圳)蘇州分公司 CHANG LONG CHEMICAL (SHENZHEN) CO.,LTD.
SUZHOU BRANCH
- ◆2007 長龍化工(深圳)青島分公司 CHANG LONG CHEMICAL (SHENZHEN) CO.,LTD.
QINGDAO BRANCH
- ◆2008 長春大連(英國)有限公司 CHANG CHUN DAIREN UK LIMITED
- ◆2010 長春(新加坡)有限公司 CHANG CHUN (SINGAPORE) PTE. LTD.
- ◆2010 長連(新加坡)有限公司 CCD CHEMICAL (SINGAPORE) PTE. LTD.
- ◆2011 長春(盤錦)有限公司 CHANG CHUN CHEMICAL (PANJIN) CO., LTD.
- ◆2011 長連(盤錦)有限公司 CCD CHEMICAL (PANJIN) CO., LTD.
- ◆2011 長春大連(德國)有限公司 CCD Germany GmbH



Main Products Using Natural Gas as Raw Material



Main Products Using Naphtha as Raw Material



Main Products of Kaohsiung Factory



- **PBT Resin**
- **PBT Compound**
- **Thermoplastic Polyester Elastomer (TPEE)**
- **Epoxy Resin**
- **Polyester Plasticizer**
- **Melamine Resin Adhesive**
- **Urea Resin Adhesive**
- **Furan Resin**
- **Amino Resin**
- **Paper Resin**
- **Epoxy diluent agent**
- **Textile Resin**
- **Acrylamide**
- **Formaldehyde**
- **Methylated amino Resin**

Milestone of CCP's PBT



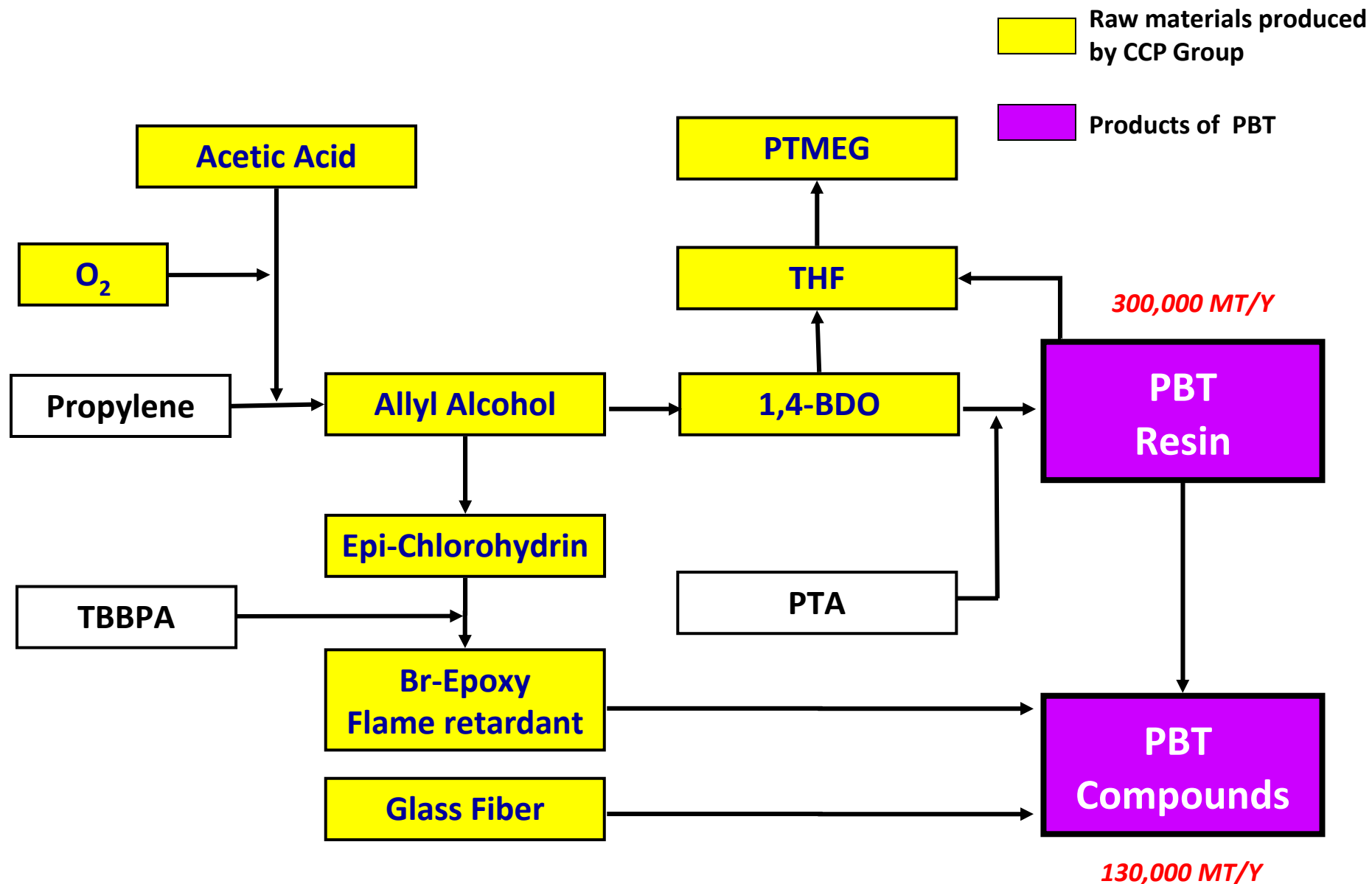
- ◆ More than 30 years of professional experience in PBT
- ◆ 1984: PBT bench scale test started
- ◆ 1988: PBT batch line started up (raw material DMT and 1.4 BDO)
- ◆ 1998: launched the first continuous polymerization process for PBT with CCP's own technique from PTA and 1.4 BDO.
- ◆ 2006: PBT compound plant completed in China Zhangzhou.
- ◆ 2012: PBT compound plant completed in China Jiangsu.
- ◆ **Capacity in 2015:**
 - PBT resin: 300,000MT/Y. (CP2, CP3, CP4, CP5 and CP6)
 - PBT compound: 130,000MT/Y.

PBT Resin & Compound Capacity

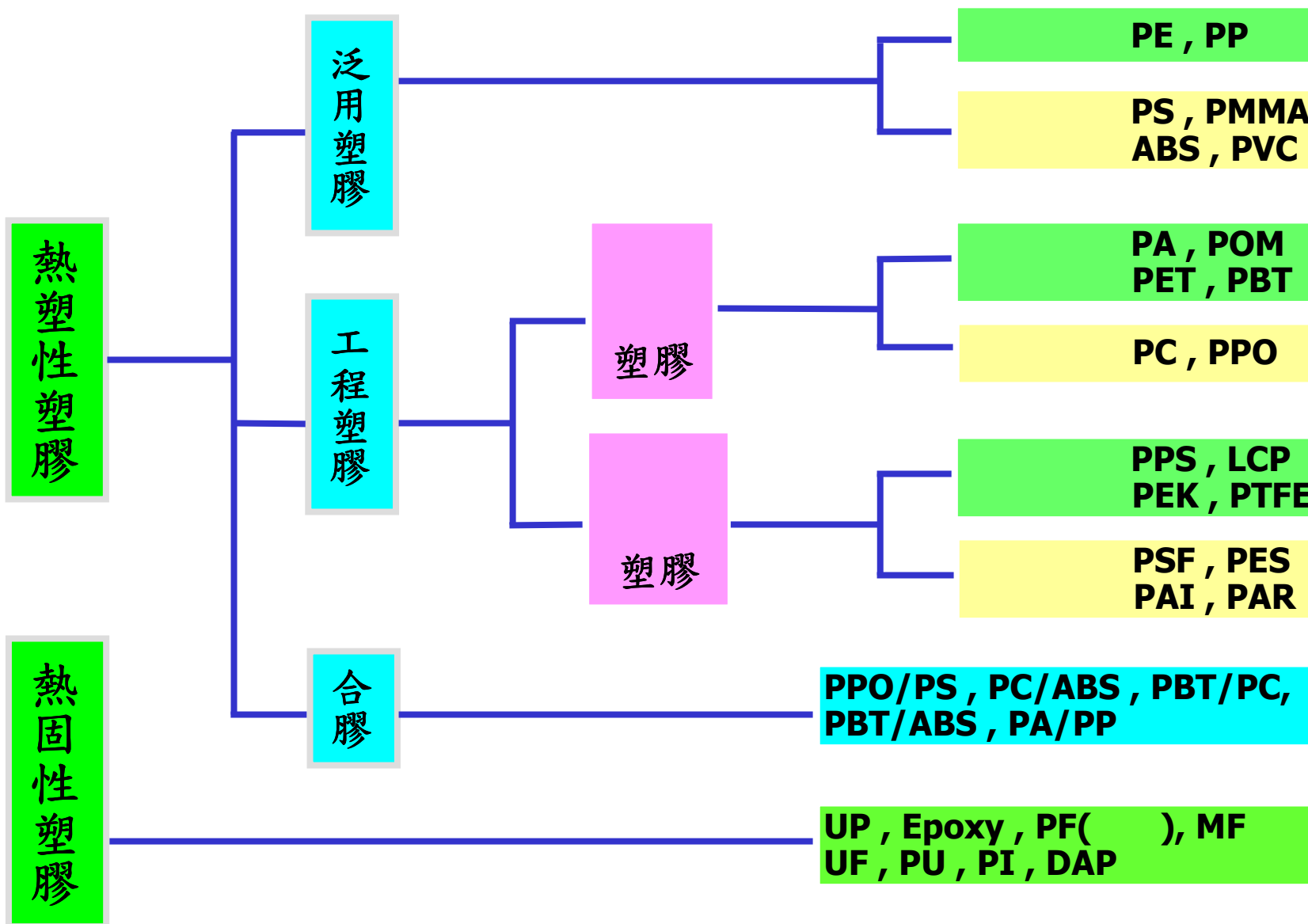
Resin	TOTAL (MT/Y)
Taiwan Kaohsiung Plant	120,000
China Changshu Plant	180,000
TOTAL (MT/Y)	300,000

Compound	TOTAL (MT/Y)
Taiwan Kaohsiung Plant	60,000
China Changshu Plant	25,000
China Zhangzhou Plant	45,000
TOTAL (MT/Y)	130,000

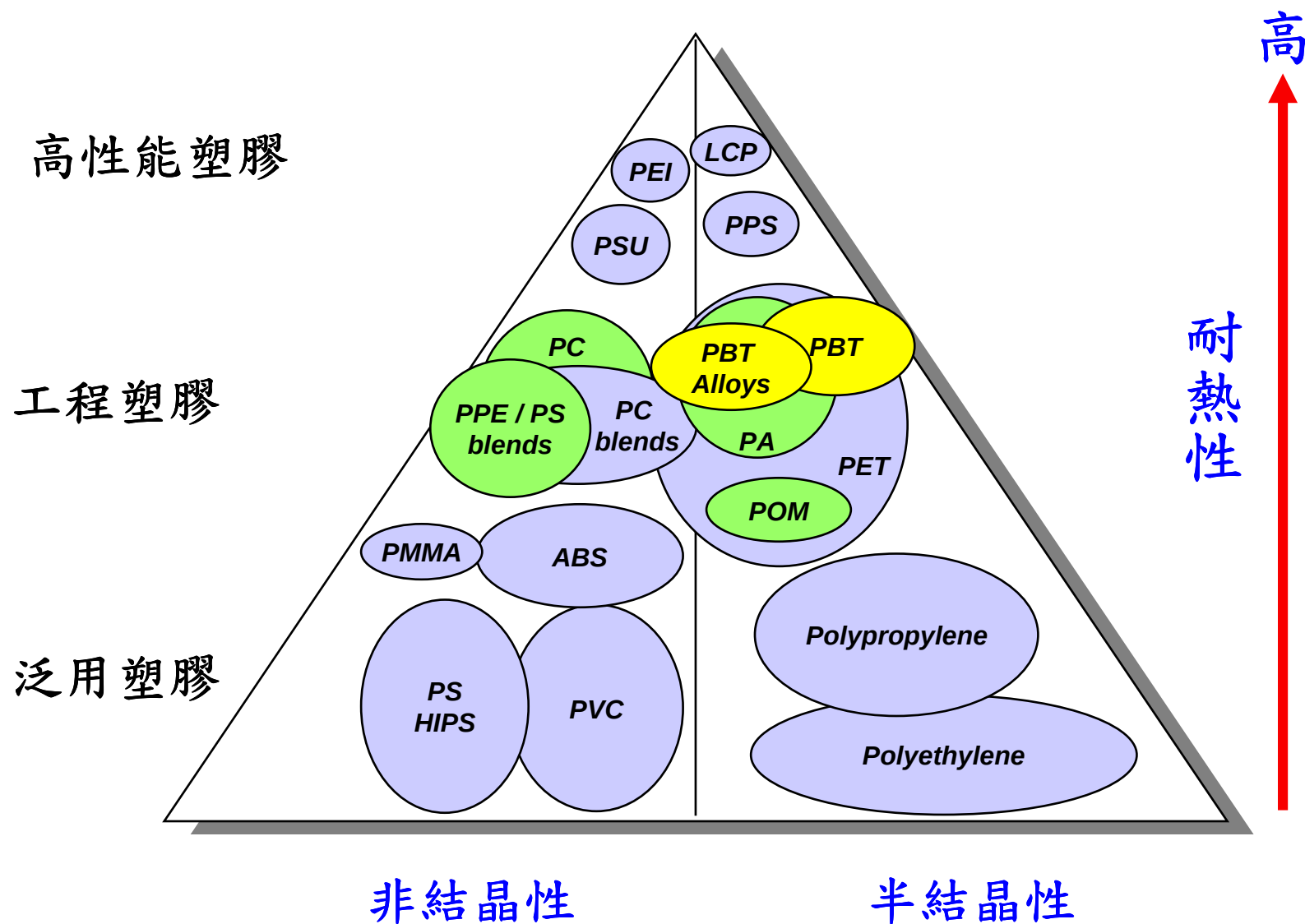
PBT Vertical Integration



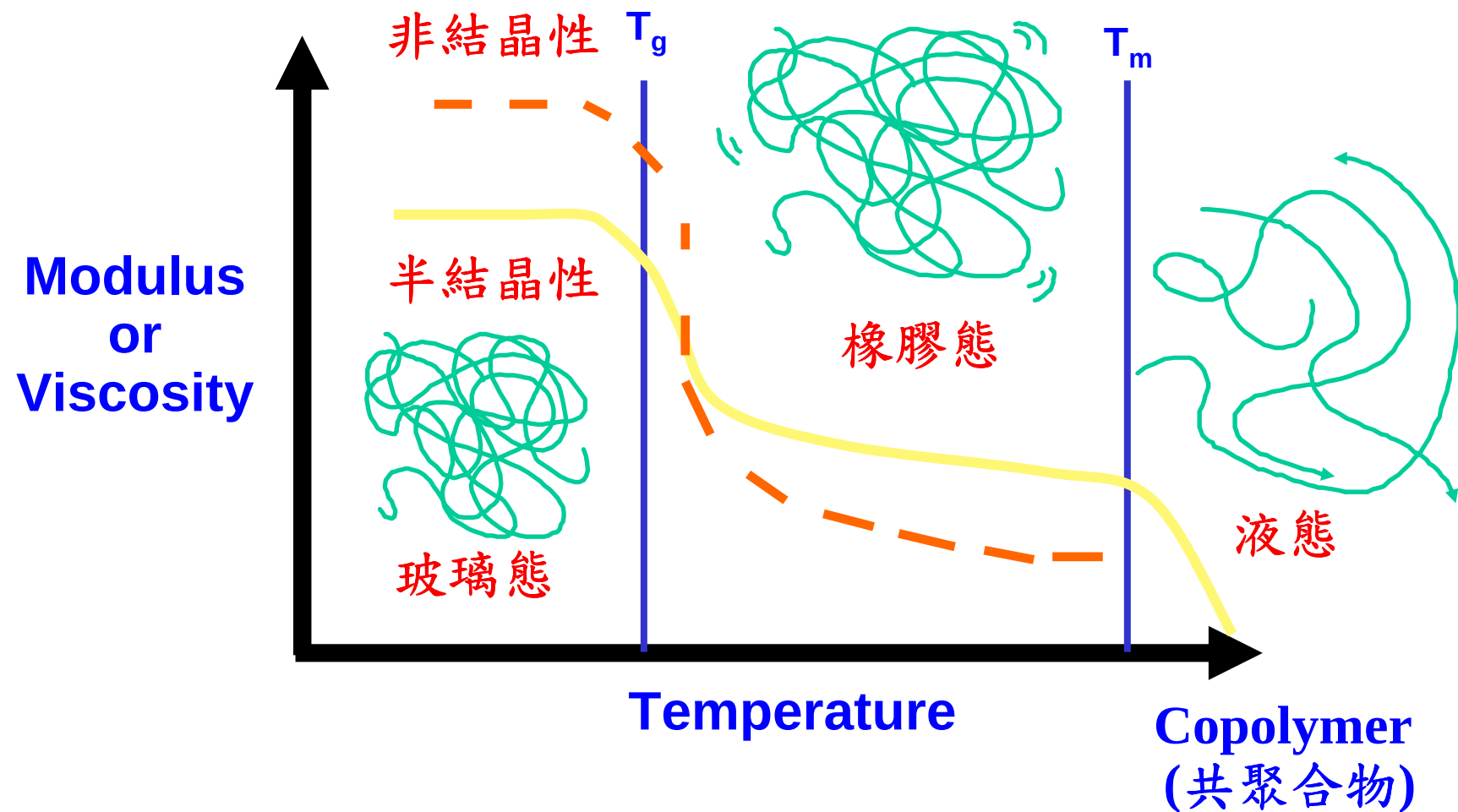
塑膠分類(1)



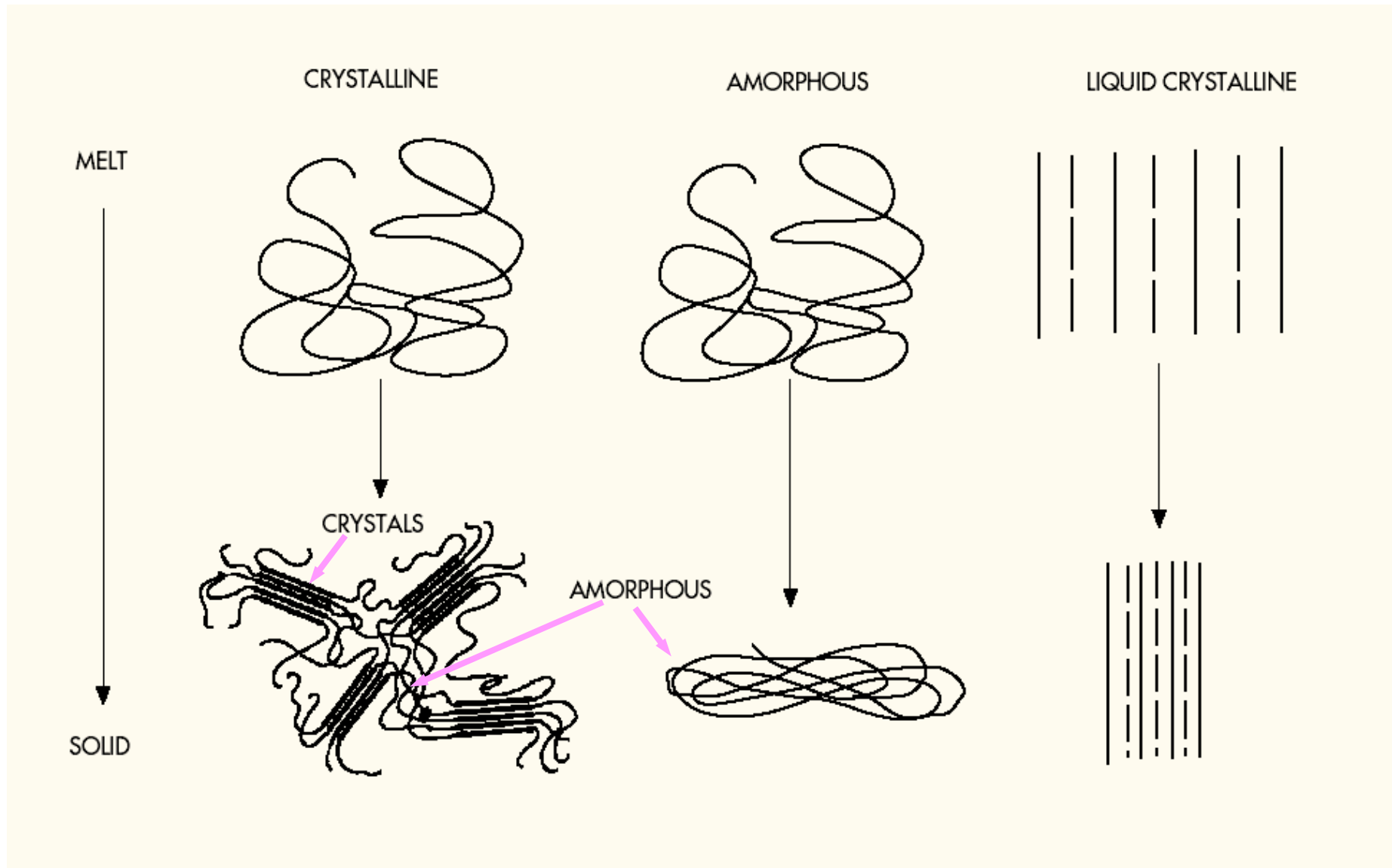
塑膠分類(2)



高分子粘彈性性質



塑膠結晶型態



塑膠收縮率

塑料名稱	成形收縮率(%)	塑料名稱	成形收縮率(%)
ABS	0.3~0.7	PBT	1.5~2.1
PC	0.4~0.8	PET	1.7~2.3
HIPS	0.4~0.8	POM	1.7~2.3
PS	0.4~0.8	PP	1.2~1.8
PAR	0.6~1.0	HDPE	1.6~2.2
PMMA	0.4~0.8	PPS	0.8~1.2
mPPO	0.5~0.9	PA-6	1.0~1.6
		PA-66	1.1~1.7
		LCP	0.1~0.7

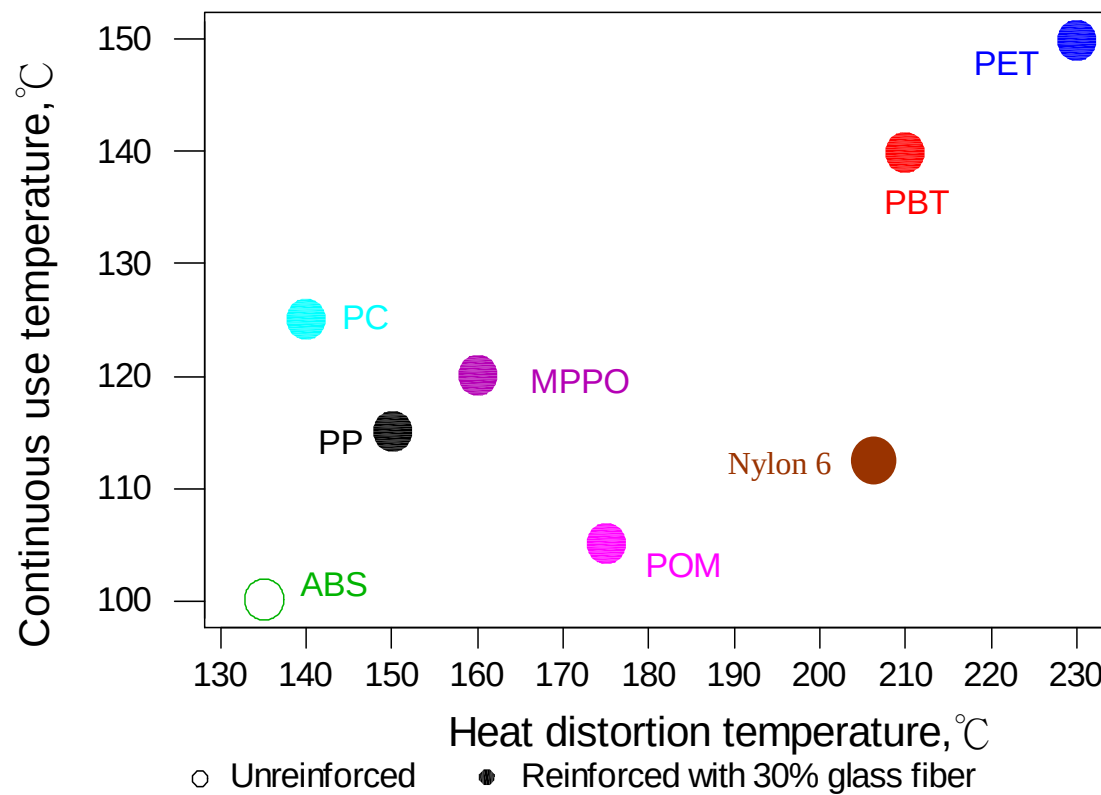
塑膠熱性質(1)

塑料名稱	T _m (°C)	T _g (°C)	HDT1.82MPa(°C)	30% GF HDT (°C)	RTI (°C)
HDPE	130~135	-110	42	120	
PP	165	-18	40	152	110
PS	—	100	79	99	90
HIPS	—	100	77	88	90
PMMA	—	105	79	93	80
ABS	—	104	99	110	80
PVC (rigid)	—	75-105	60~75	—	90
mPPO	—		88	149	100 (110)
POM	166-171	-75	105	160	80 (105)
PC	—	150	133	149	110 (130)
PAR	—	190	175	180	
PBT	225	50	55	210	120 (140)
PET	255	79	85	227	120 (150)
Nylon 6	220	60	65	205	105 (115)
Nylon 6, 6	260	72	71	250	105 (125)
PPS	280	90	135	260	220

半結晶性塑膠添加30%GF之HDT可接近熔點

塑膠熱性質(2)

Short term and long term temperature limits



PBT簡介(1)

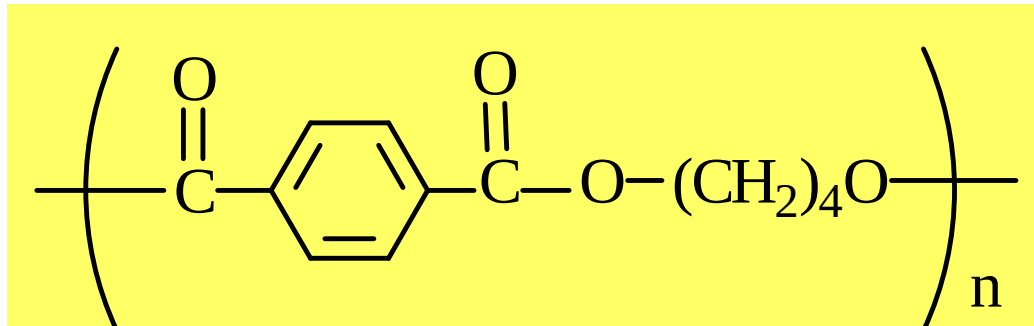
❖ P B T : Polybutylene terephthalate

學 名：聚苯二甲酸丁二酯

聚丁烯對苯二甲酸酯

聚對苯二甲酸丁二醇酯

❖ 化學式：



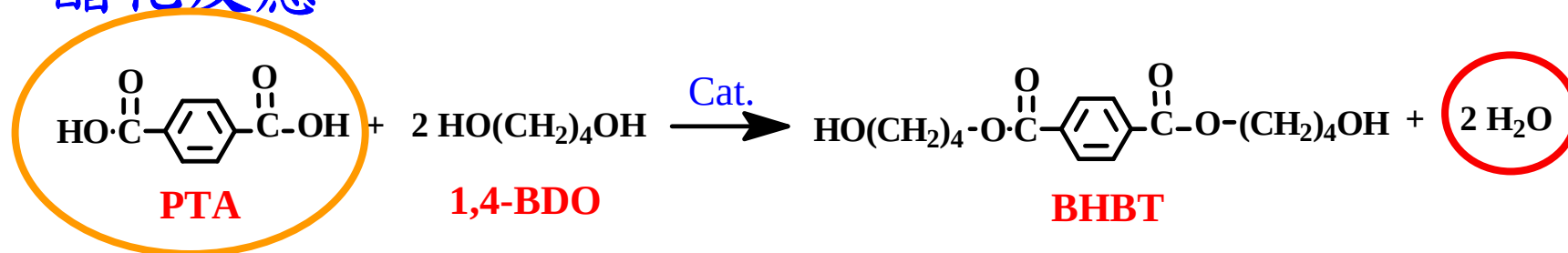
❖ 1942年德國科學家P. Schlack發明

❖ 1970年美國Celanese(現為Ticona) 工業化生產

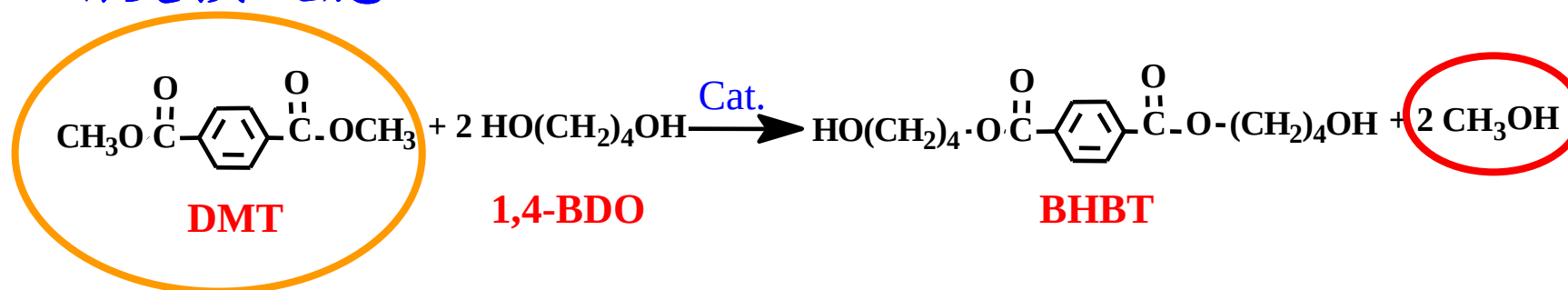
PBT簡介(2)

反應流程介紹：

酯化反應

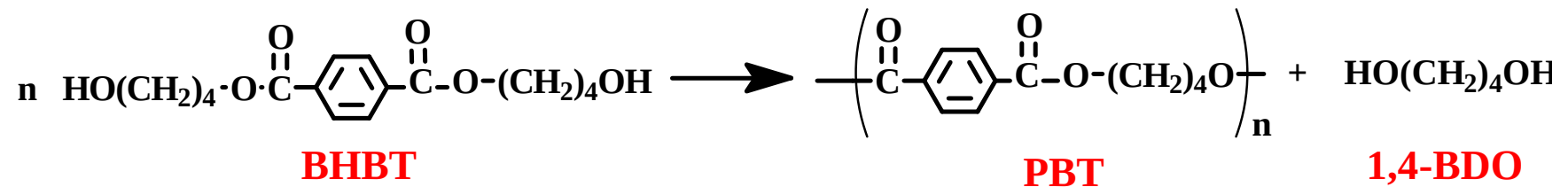


酯交換反應

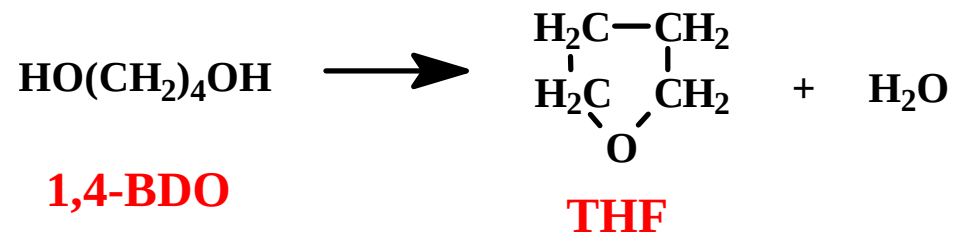


PBT簡介(3)

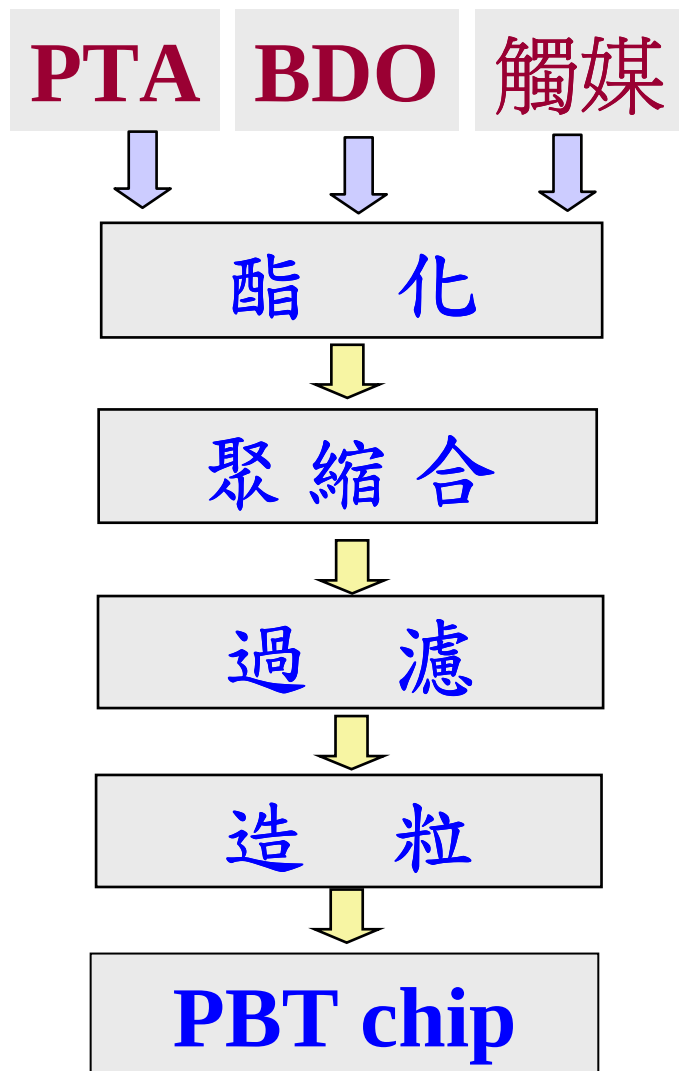
聚縮合反應



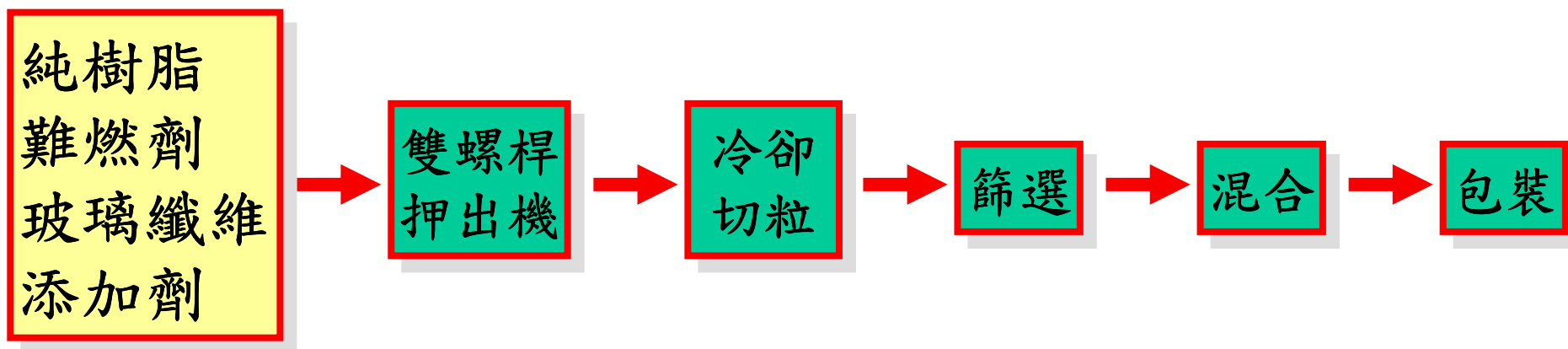
副反應



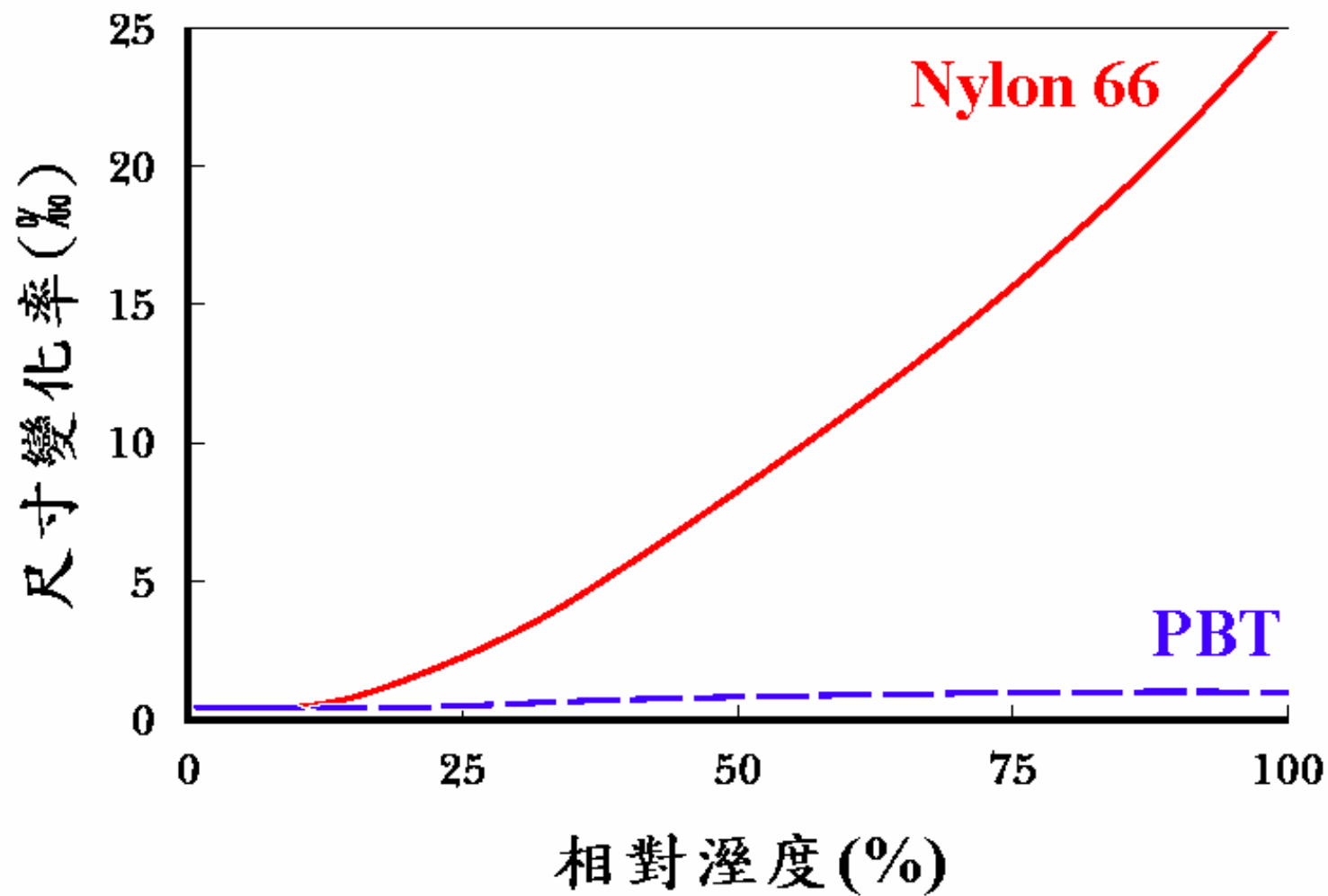
PBT 純樹脂製造流程



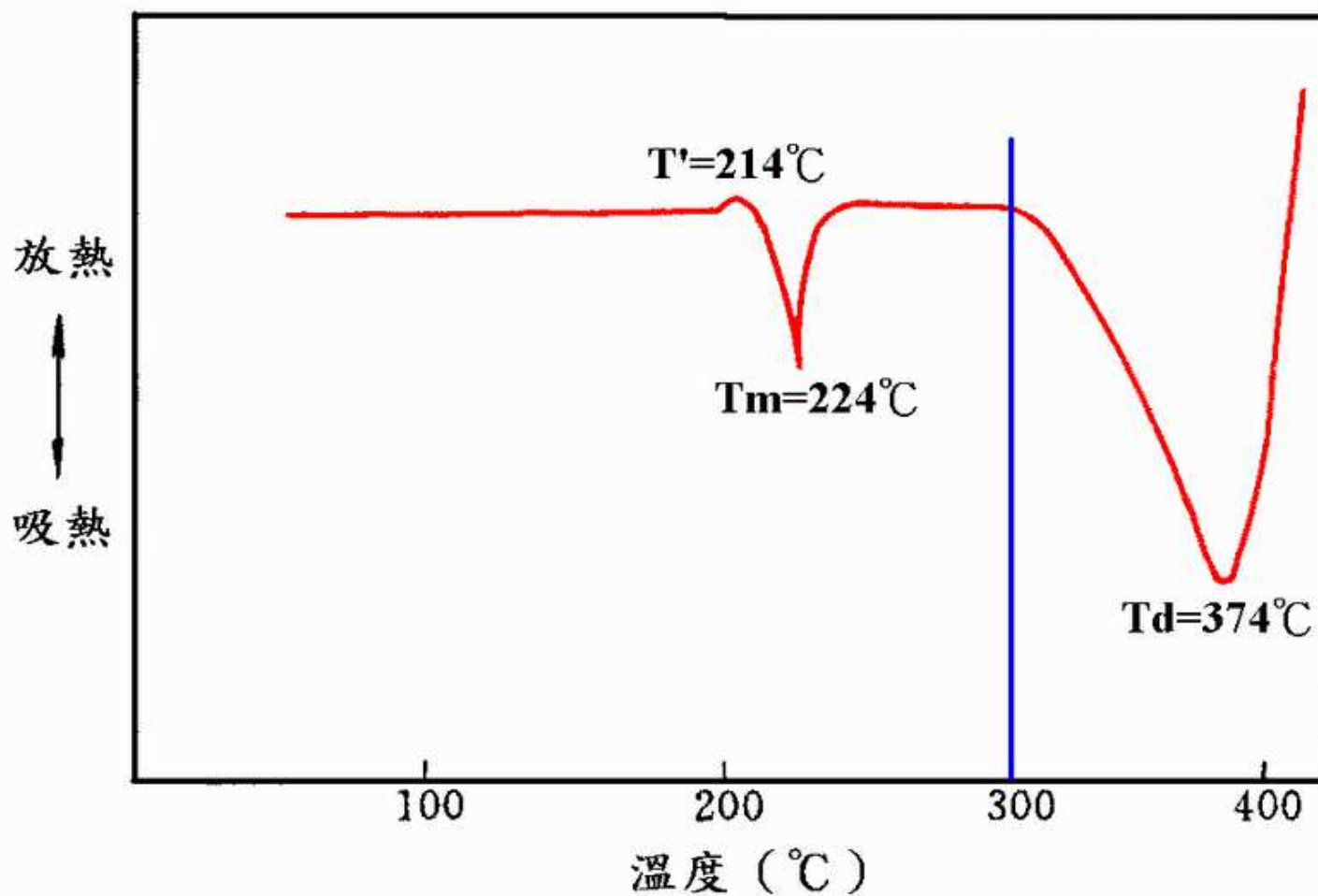
PBT複合材料生產流程



PBT尺寸安定性



PBT熱性質



214 $^{\circ}\text{C}$ 開始熔融，300 $^{\circ}\text{C}$ 開始分解

PBT耐化學品性質

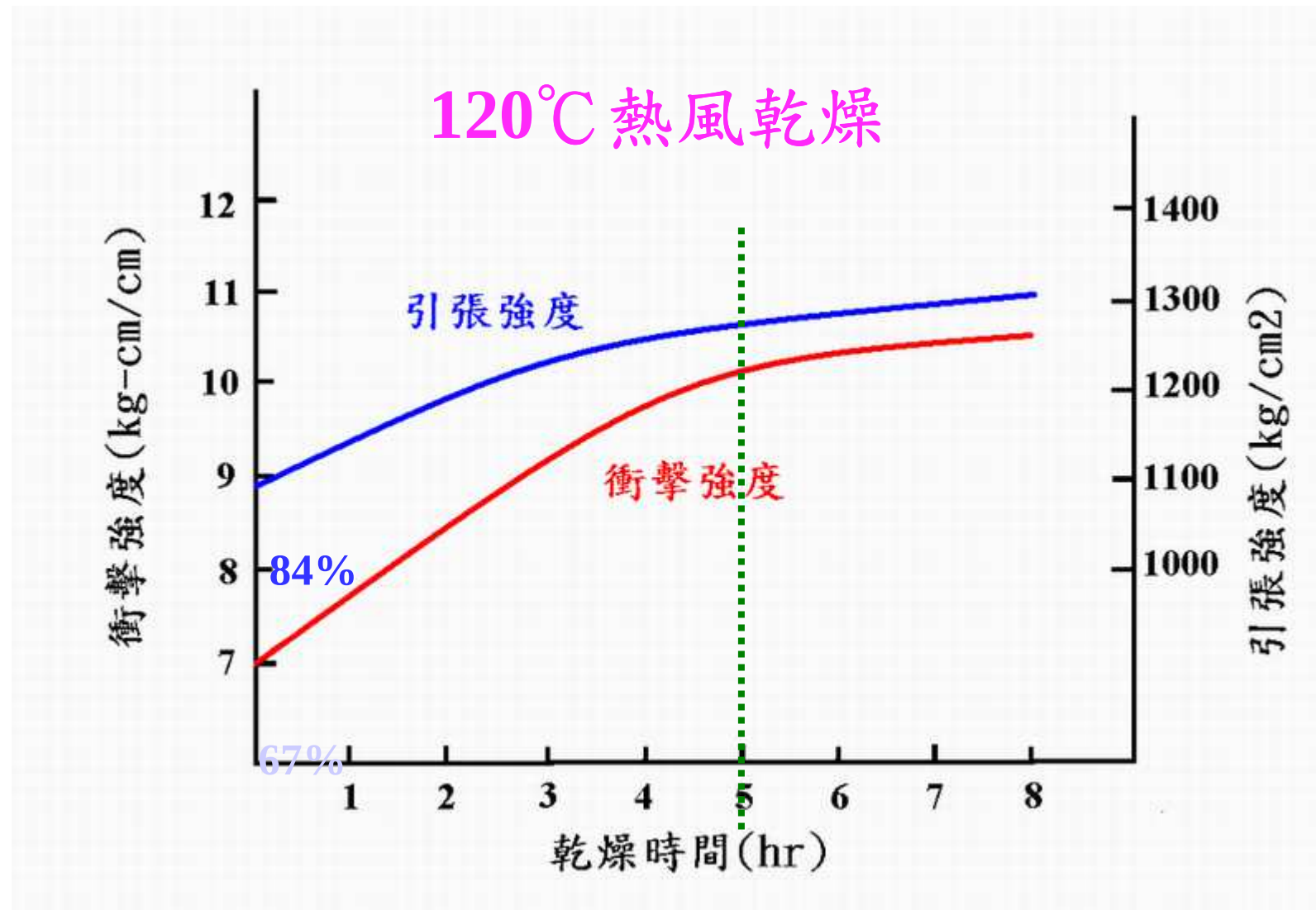
樹脂 藥品	PBT	POM	PC	變性 PPO	Nylon 6
30%硫酸	○	○	○	○	×
10%硝酸	○	○	○	○	×
10%鹽酸	○	○	○	○	×
蘇打	×	○	×	○	○
氨水	○	○	×	○	△
甲醇	○	○	△	○	×
乙醇	○	○	○	○	△
丙酮	○	○	×	×	○
氯化甲烷	△	×	×	×	—
四氯化碳	○	○	×	×	○
庚烷	○	○	○	○	○
甲苯	○	○	×	×	○
汽油	○	○	○	×	○
機油	○	○	○	—	○

○：優 △：普通 ×：劣

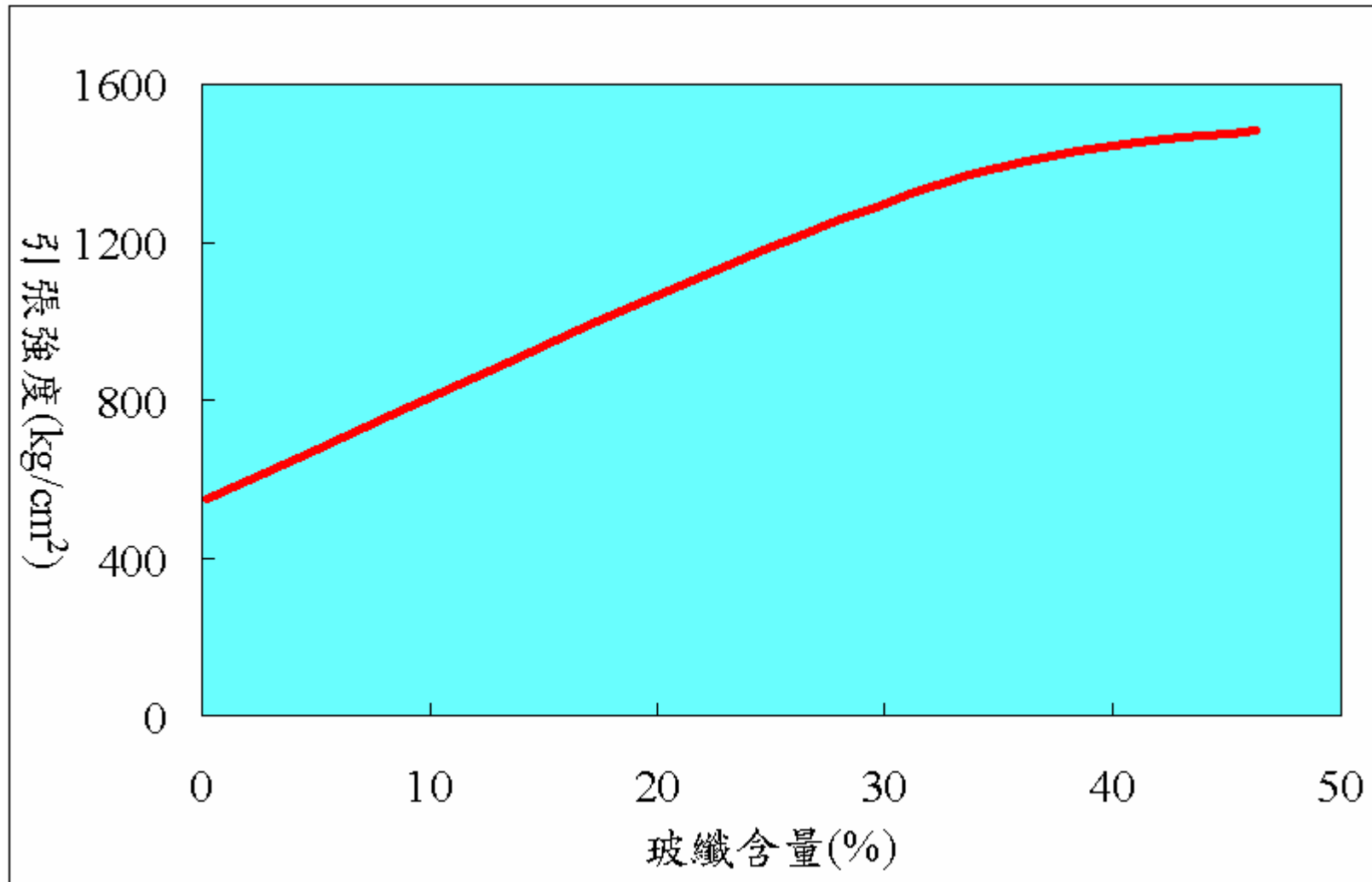
PBT特性

- ✦ 結晶速度快，易成型，成形週期短。
- ✦ 融點高達225°C，耐熱性(耐熱劣化)佳。
- ✦ 玻璃纖維強化，機械強度大
- ✦ 吸水率低，尺寸安定性佳。
- ✦ 磨擦係數低，耐磨耗(玻璃強化級亦然)。
- ✦ 耐化學品、溶劑、耐候性佳。
- ✦ 彎曲蠕變性質佳。
- ✦ 可製成難燃級，符合UL 94V-0要求。
- ✦ 介電强度高，電氣性質佳。
- ✦ 可以超音波熔接，組立加工容易。

PBT強度與乾燥時間之關係



PBT強度與玻纖含量之關係



PBT Neat Resin Grade

Designation	Series	Grade	Description
PBT Resin	1000	1200-211E	IV = 0.68
		1200-211D	IV = 0.75
		1200-211L	IV = 0.79
		1200-211M	IV = 0.83
		1200-211F	IV = 0.85
		1100-211D	IV = 0.88
		1100-211A	IV = 0.92
		1100-211L	IV = 0.94
		1100-211M	IV = 1.00
		1100-211H	IV = 1.10
		1100-211S	IV = 1.20
		1100-211X	IV = 1.30

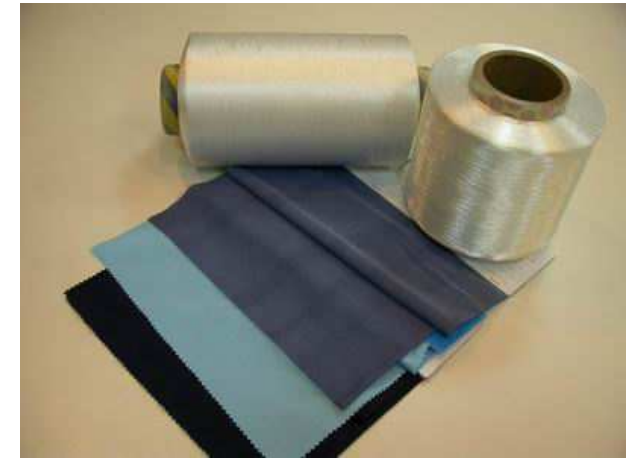
PBT Neat Resin Application



Loose tube



PBT monofilament



PBT fiber and textile



Rainbow film

PBT film applications

- Release film
- Metal decoration
- Food package
- Can cover
- insulation film

PBT compound

- Connector
- Bobbin
- Cooling fan
- Head lamp bezel
- Etc.....

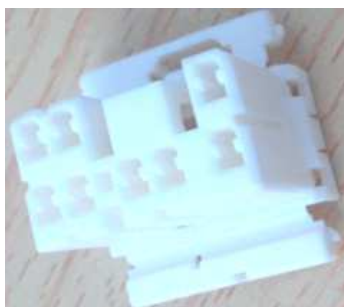
CCP PBT Compound's Innovations for Special Grades

Series	Descriptions	Example
1000	HB, unreinforced	1100-630S, 0% GF, HB
2000	V0, unreinforced	2100-200K, 0% GF, V0
3000	HB, GF reinforced	3020-200XS, 20% GF
4000	V0, GF reinforced	4130F-104B, 30% GF
5000	Halogen free V0, GF=0~30%	5630-258V, 30% GF
6000	PBT/PC alloy (HB:6000, V0:6100)	6000-250, 0% GF, HB
7000	PBT/ASA (HB: 7000, V0: 7100)	7030-104, 30% GF, HB
	PBT/ABS (HB: 7300H, V0: 7300)	7320H-104, 20% GF, HB
9000	PET compound (HB: 9000, V0: 9100)	9035-104, 35% GF, HB

CCP Grades for Automotive Connectors

CCP PBT 1100 series

Grade	1100-630S	1100-211LC1	1100-205S	1100-207S	1100-208HS	1100-220S	1100-245Q
Melting Index @250℃ , g/10min	21.3	36.5	15.9	11.1	11.9	9.2	8.7
Melting viscosity @260℃ , poise	2090	1410	2180	2300	1900	1870	2260
Tensile strength, MPa	56	56	51	48	47	38	42
Tensile elongation, %	86.2	13.7	32.1	130	16.3	25.4	285
Flexural strength, MPa	82	80	75	72	70	55	36
Flexural modulus, MPa	2210	2200	2040	1920	1860	1470	839
Charpy impact strength, KJ/m2	5.5	5.6	8.8	10.4	10.2	42.3	77.8
Specific gravity	1.3	1.3	1.28	1.29	1.27	1.22	1.26
Heat deflection temperature, ℃	60	60	60	60	58	55	50



CCP Grades for Automotive Connectors

CCP PBT 1000 & 3000 series

Description	GRADE	Melting Index, g/10min	Tensile Strength, MPa	Tensile Strain, %	Flexural Strength, MPa	Flexural Modulus, MPa	Charpy Impact, kJ/m ²	Specific Gravity
PBT	BASF B4520	22	53	85	80	2300	5.1	1.31
	1100-630S	21	55	100	85	2200	5.5	1.31
PBT GF-15 (High-speed)	B4300G3 HS	30	105	3.4	160	4900	5.4	1.41
	3015-200XH	40	110	3.6	165	5100	7.7	1.41
PBT GF-15	Dupont SK602	17	105	3.4	155	4500	6.5	1.41
	3015-202X	14	100	3.6	150	4300	9.0	1.40
PBT GF-20	BASF B4300G4	19	118	3.0	170	7100	7.2	1.45
	3020-200X	15	115	3.0	166	6700	10.8	1.44
PBT GF-30	BASF B4300G6	13	130	2.5	200	8500	11.0	1.53
	3030-200X	10	145	2.5	210	8000	12.0	1.53



*For the same main grades, we can modify customers' request according to their design.

CCP Grade for Automotive Head Lamp

Grade	1100-103A	1100-200A	1100-134A 1100-230A	3020-104FM 3020-222FM	3020M-104 3020M-210	3020-222EM
Melting Index @250°C , g/10min	35	42	18	65 (270°C)	35 (270°C)	15 (270°C)
ASH, %	0	0	0	20 (Mineral)	20 (Mineral)	20 (Mineral)
Tensile strength , MPa	58	55	50	50	50	45
Flexural strength , MPa	85	82	75	82	80	75
Impact strength-notched, kJ/ m ²	4	4.5	4.5	2.8	3.2	5
Density	1.31	1.31	1.21	1.46	1.46	1.45
HDT @1.8MPa, °C	60	60	80	70	70	70
Shrinkage,1.6mm, %	1.8-2.2	1.5-2.0	0.7-1.3	1.0-1.5	1.0-1.5	0.7-1.6
Mark	Direct-metalization	Direct-metalization	Direct-metalization	High-flow	-	-



*For the same main grades, we can modify customers' request according to their design.

Mechanical Strength & Impact Improved Grades

✚ PBT 3030 – series

GF : 30%

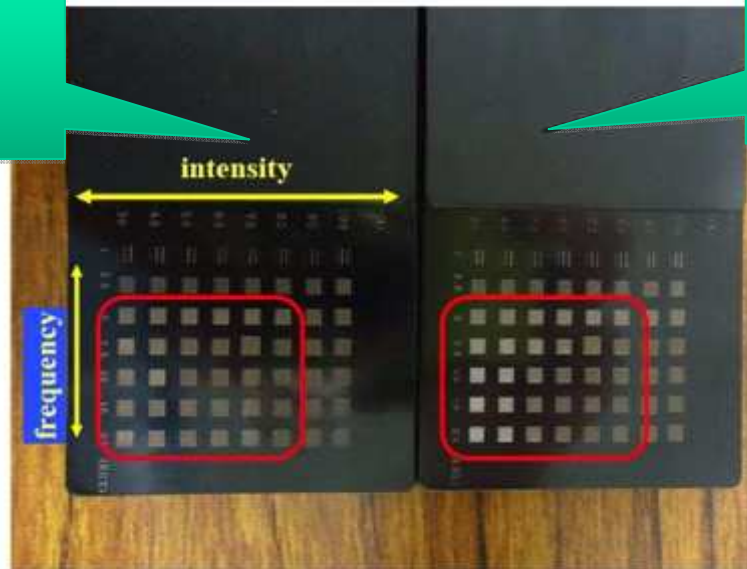
Flammability : HB (UL 94)

Grade	3030-104	3030-104X	3030-104XS	3030-104XR	3030-104XH
Properties	Standard	Rigidity improved	Rigidity & Impact improved	Rigidity & Anti-hydrolysis improved	Rigidity & High flow
Melting Index, 250 °C, g/10min	18	12	7	15	35
Density	1.53	1.53	1.50	1.53	1.53
Tensile Strength, MPa	125	135	125	145	135
Flexural Strength, MPa	190	195	185	210	195
Impact Strength, KJ/m ²	8.0	8.5	14.0	9.0	8.3
Heat Deflection Temp., 1.86MPa, °C	200	200	200	200	200

Laser Markable Grades

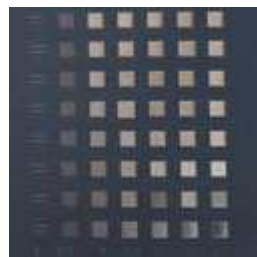
- Laser Markable Grades – 3030-104L
 - Comparison of two formula to satisfy customers' trial

Standard grade, which shows poor lasermarkable effect.



The lasermarkable effect is better, and the contractness is good.

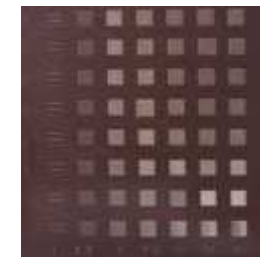
- Precolored Lasermarkable Grades



RAL 7024



RAL 8014



RAL 8017

Less Gas Emission & Glue Adhering Grades

+ N-type Grades for glue adhering – 3030-104X**N**

+ Experiment

Glue type : silicone type

CCP N type grade shows good result at adhering of the specimen.



Competitor grade



CCP **N type** grade

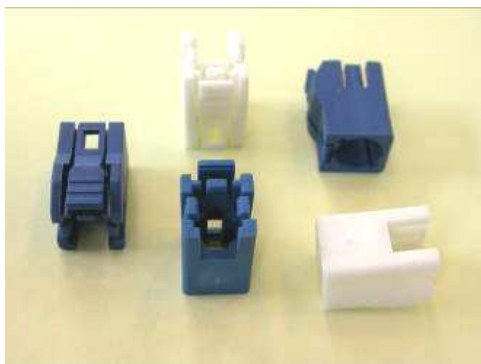


CCP standard grade

CCP PBT and other manufacturer's equivalent product

Description	GRADE	Tensile Strength	Tensile Strain	Flexural Strength	Flexural Modulus	Charpy Impact	Specific Gravity	Remark
PBT GF-30	Competitor	111	2.0	-	7900	-	1.53	Hydrolysis-resistance
	3030-104FR	130	2.3	185	7100	11.0	1.49	
PBT GF-30	Competitor	135	2.9	-	8820	8.3	1.53	-
	3030-104X	135	2.5	195	7800	8.5	1.53	
PBT	Competitor	57	>50	-	-	4.5	1.31	-
	1100-104S	58	30.0	87	2300	5.0	1.31	
PBT GF-15	Competitor	88	8.0	147	4410	12.0	1.37	High-toughness
	3015-205S	85	4.0	130	4000	12.0	1.38	
PBT GF-30	Competitor	140	2.5	-	-	-	1.54	High-speed
	3030-104XH	130	2.1	185	7200	8.0	1.53	
PBT GF-30	Competitor	135	2.7	-	8600	8.0	1.53	-
	3030-104X	135	2.5	195	7800	8.0	1.53	
PBT GF-30	Competitor	135	2.5	-	8800	11.0	1.53	-
	3030-200X	140	2.5	200	7800	9.0	1.53	
PBT GF15	Competitor	102	3.4	-	-	6.0	1.41	-
	3015-104X	100	3.4	150	4600	5.5	1.41	
PBT GF15	Competitor	100	3.5	-	-	5.5	1.41	High-speed
	3015-200XH	105	2.7	150	4500	6.5	1.41	
PBT GF-30	Competitor	145	2.7	-	-	10.0	1.53	High-speed
	3030-200XH	145	2.5	205	7200	10.0	1.53	

Automotive Applied Components



Electric Applied Components



Home Appliance Components



Black on White



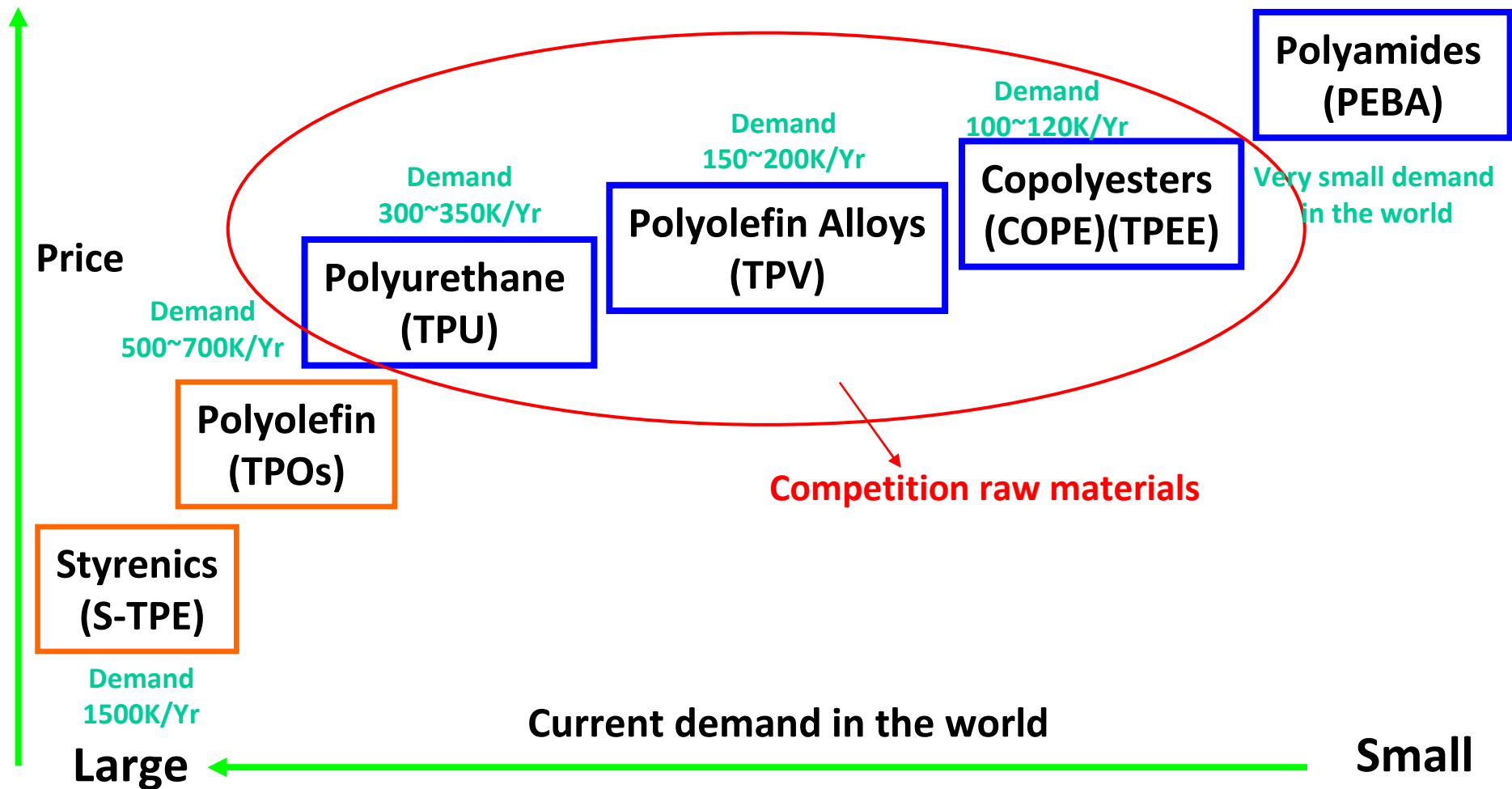
White on Black



TPE Family information

Expensive

Engineering TPE (high performance)



TPE Family information

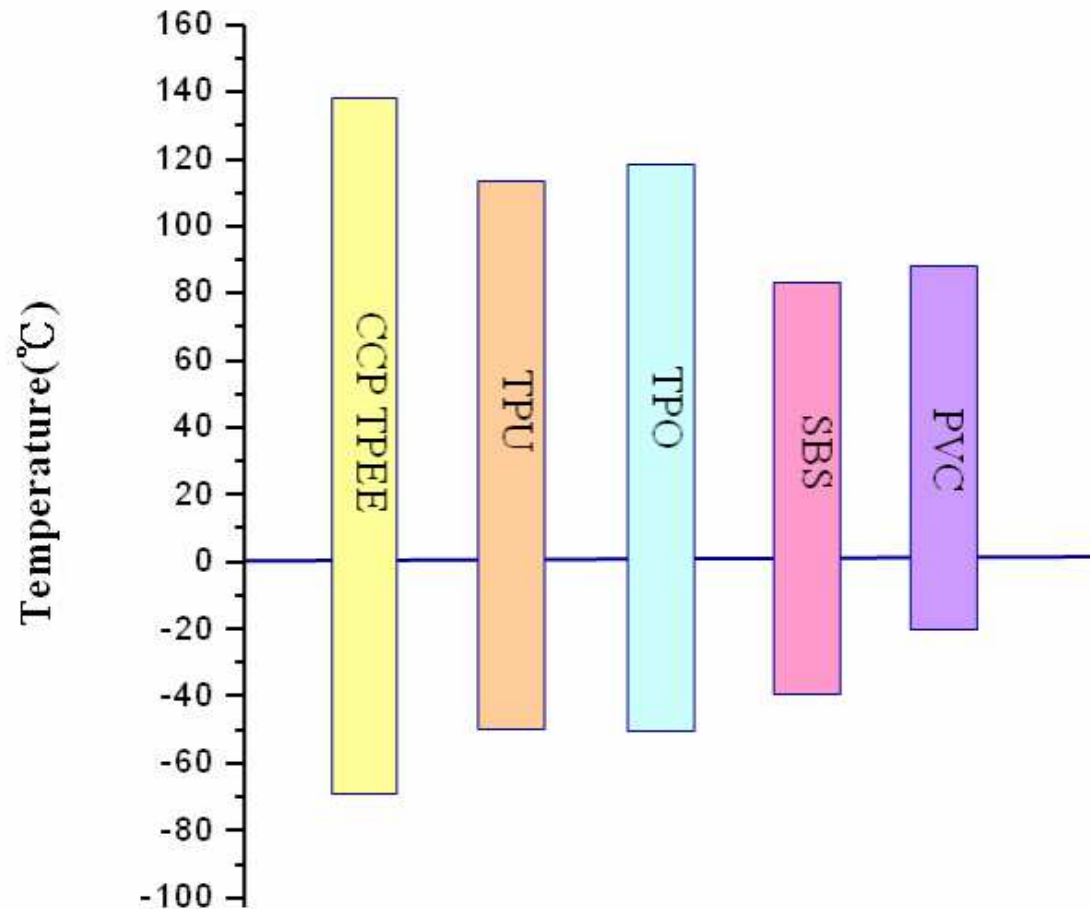
Selected TPE Properties :

Type	SBC	TPO	TPU	TPEE	TPAE	PVC
Hardness	37A~71A	60A~95A	30A~80D	30D~75D	40D~62D	40A~70A
Density	0.91~0.95	0.91	1.1~1.25	1.08~1.26	1.01	1.2~1.3
Resistance to Abrasion	△	×	◎	△	○	△
Resistance to Flexure	○	△	◎	◎	◎	○
Heat Resistance	60°C	120°C	100°C	140°C	100°C	100°C
Resistance to fuel, oil, & fats	×	△	◎	◎	◎	×~△
Weatherability	×~△	○	△~○	△	○	△~○

◎ : Excellent ○ : Good △ : Ordinary × : Poor

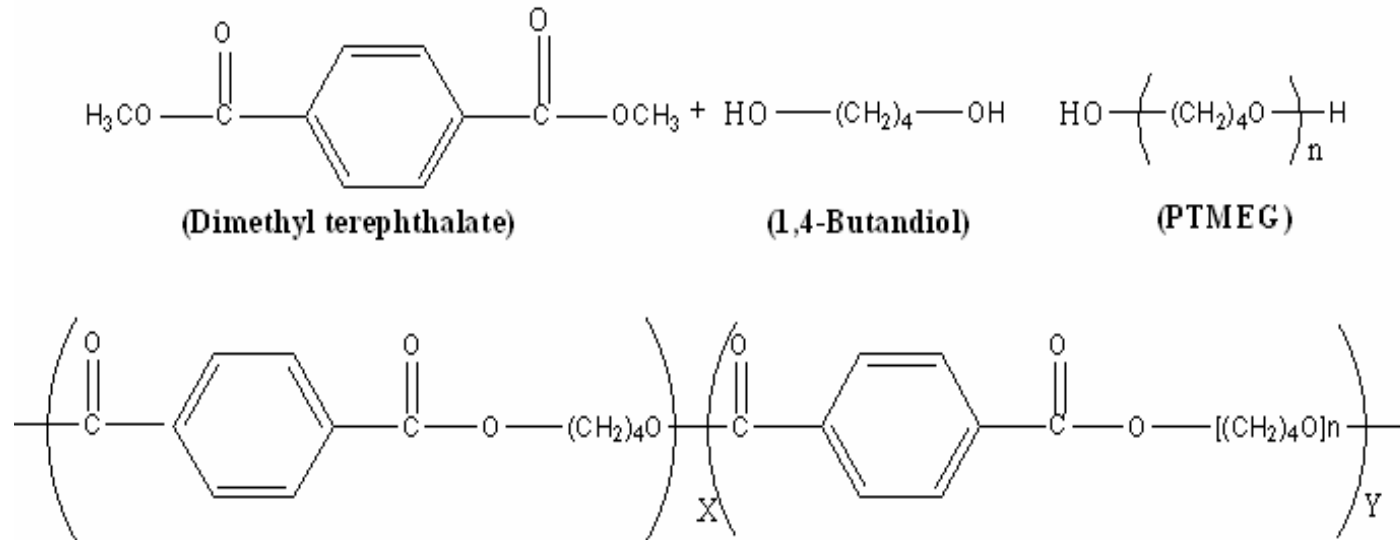
TPE Family information

Temperature using range of various Elastomers
-TPEE show the best wide temperature range for using



TPEE chemical structure

Thermoplastic polyether ester elastomer



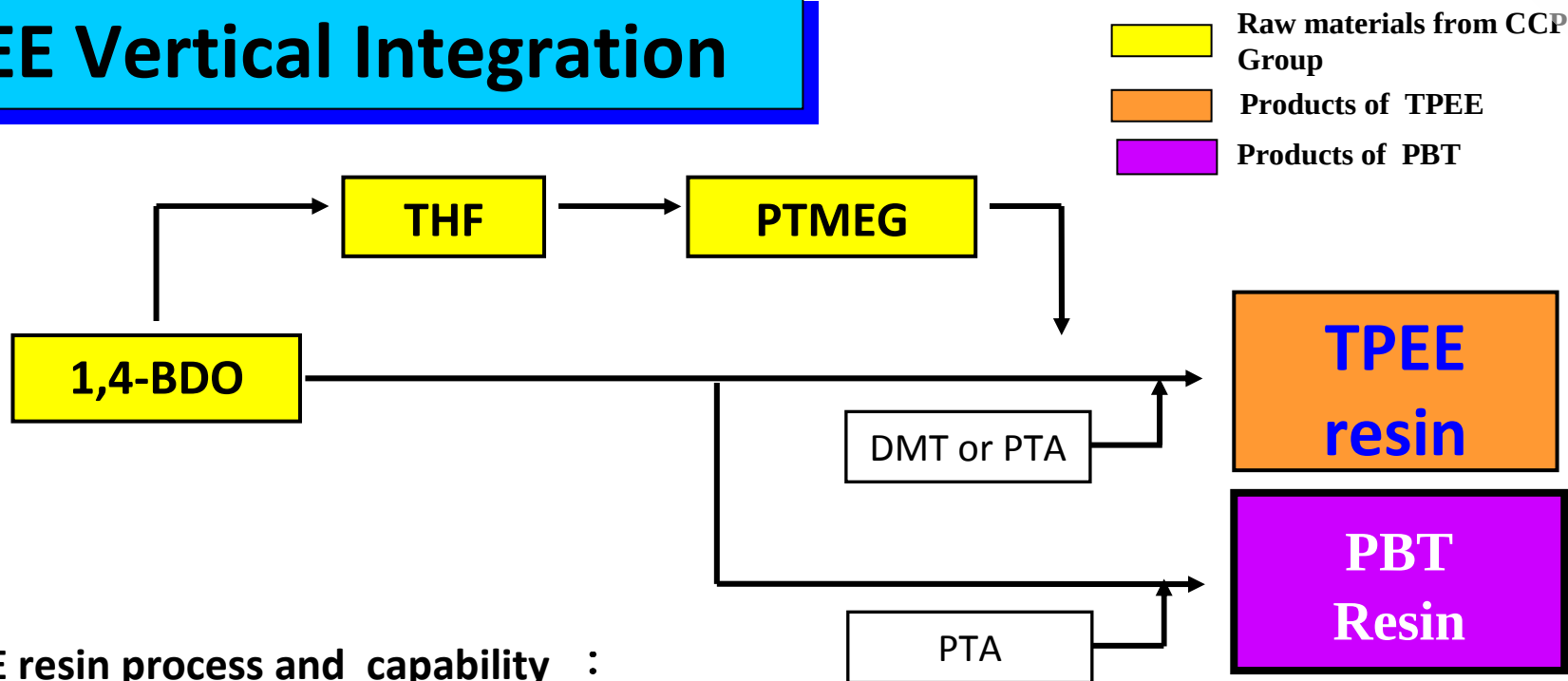
- Hard segment-Crystal
- Strength/Durability
- Chemical/Oil resistance
- Heat resistance
- Processing

- Soft segment-Amorphous
- Impact resistance
- Resilience
- Low temperature properties
- Flex fatigue resistance

Milestone of CCP's TPEE

- 2006: TPEE bench scale test started.
- 2008: TPEE batch line (A/B Line) started up (raw material DMT, 1.4 BDO and PTMEG)
- 2012: launched the first continuous process polymerization line (C Line) for TPEE with CCP's own technique.
- 2014: New TPEE continuous process production Line (D Line)
> capacity : 12,000 MT/Year.
- **Capacity in 2015:**
 - **TPEE resin: 17,400MT/Y.**

TPEE Vertical Integration



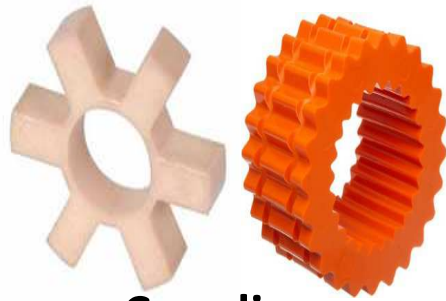
◆ TPEE resin process and capability :

	Total (MT/Y)
Batch Process	3,000
Continuous process	14,400
Total	17,400

TPEE Grades

Designation	Molding	Grade	Hardness	MFR
			Shore D	230℃ , 2.16Kg
CCP TPEE	Injection	1130-201LH	30	15
		1140-201LH	40	15
		1148-201LL	48	20
		1155-201LL	55	20
		1163-201LL	63	20
		1172-201LL	72	20
	Extrusion	1140-201MH	40	9
		1155-201ML	55	8
		1163-201ML	63	8
		1172-201ML	72	9
		1163-104XL	63	4
	Blowing	1143-104XH	43	1
		1155-104XB	55	0.6

TPEE Application



Coupling



Seal



Gears



monofilament



Belt



Hose



Air duct



Boots



Air bag cover

Certificate of ISO / TS

Factory	Established Year	PBT commercial production	ISO 9000	ISO 14000	QS9000/ TS16949
Taiwan Kaohsiung	1972	1988	1990	1996	2006
Zhangzhou (Fujian Prov.)	2003	2006	2007	2007	2012
Changsu (Jiangsu Prov.)	2002	2007(resin) 2011(compound)	2007 2011	2007 2011	2012





Thank you for your attention !