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◎ 乾燥 (Pre-Drying)

1. 在成型前，無論TPU原料包裝良否，皆必須預先乾燥。
2. 由於TPU易吸濕及易水解特性，未充分乾燥的TPU原料易導致加工困難，射出品表面不良及成品物性的降低，所以在成型前必須先把TPU原料充分乾燥至含水量200ppm(0.02%)以下。
3. 若使用色粉(Pigment)或色母(Color Masterbatch)染色，必須與TPU本色粒子充分混合後，一起乾燥。
4. 由於TPU化學結構關係，TPU粒子暴露至空氣中，吸濕相當快速，尤其聚醚比聚酯更易吸濕。以U-95A & UE-95A為例，比較如《附表1》：在環境25°C，50%RH下。

U-95A UE-95A

Water Content 含水量 時間 Time	Grade 規格	U-95A	UE-95A
	4 hrs		0.10 wt%
24 hrs		0.25 wt%	0.35 wt%

5. 無論傳統的循環氣體乾燥箱 (Circulating Air Hopper) 或除濕乾燥機 (Dehumidifier) 皆可用來乾燥TPU，建議的乾燥條件如下：

Shore 60A~80A : 90~100°C, 3~5hrs。
 Shore 85A~98A : 100~105°C, 3~5hrs。
 Shore 60D~71D : 105~110°C, 3~5hrs。

◎ 回收料 (Recycling of Scrap)

水口(Sprues)及澆道(Runners)或不良成品可以粉碎後再與新料混合後使用，但必須先再一次乾燥後才可使用，且爲了某些機械物性的要求，對於射出成型加工而言，回收料不可超過整體原料30wt%以上。另外回收料不要儲存太久，最好馬上乾燥使用。

◎ Pre-Drying

1. Before molding, the TPU raw material must be dried regardless whether it is properly packed or not.
2. Because of easier moisture absorption and hydrolysis characteristics, if the TPU raw material is not fully dried it tends to cause difficult processing, a poor surface of the finished components and the lowering of mechanical properties. Therefore, TPU pellets must be dried till the water content becomes lower than 200 ppm (0.02%) before molding.
3. If the pigment or color masterbatch is used, they must be fully mixed with TPU pellets then drying together.
4. Due to the chemical structure, the TPU pellets absorbs moisture very quickly when exposing pellets in the air. Especially the ether-type TPU absorbs moisture quicker than the ester-type TPU. For example, U-95A and UE-95A grades, both are compared in Table 1 under 25°C and 50% relative humidity.
5. Regardless of conventional circulating air hopper or dehumidifier, both can be used for TPU drying. Listed below are the recommended drying conditions:

Shore 60A~80A : 90~100°C, 3~5hrs。
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◎ Recycling of Scrap

The sprues and runners can be crushed for mixing with virgin material, but one more drying process would be required before use. To meet certain mechanical properties requirement, the recycled scraps cannot be more than 30wt% of the total material. Besides the recycled scraps should not be stored too long time. It is the best to be dried immediately for use.

● 回火處理 (Post-Treatment)

- 1. 回火後處理可以得到TPU最好及最終穩定的機械物性，對於某些高性能成品及急欲知道物性結果的部品(如試片)需要回火處理。
- 2. 建議的回火條件如下:

《附表2》
《Table 2》

溫度 Temp	時間 Time	20 hrs
硬度 Hardness		100°C
Shore 90A (含) (included) 以上 ↑		80~90°C
Shore 90A (不含) (excluded) 以下 ↓		

↑
20 hrs

3. 若將射(押)出部品置於室溫(25°C)空氣中，約4~5星期後，所得到的機械物性約與回火處理後所得到的機械物性接近。

● 加工環境與環保建議

Utechllan® TPU和一般熱可塑性塑橡膠相同，在某個溫度以上也會分解，當充分乾燥後的TPU粒子加工中有煙氣產生時，代表原料已發生分解；通常Utechllan® TPU大約在溫度230°C時開始緩慢分解，所以操作間要通風及有效排氣設備。Utechllan® TPU的材質不會污染環境，不能再加工的廢棄物可丟棄在一般垃圾場或焚化廠，但必須遵守環保規章。

● 包裝及儲存 (Package & Storage)

- 1. 本公司TPU包裝是25Kgs為1包的多層紙鋁箔包裝(Paper Al Bag)內裝在 PE Film 袋裡，原包裝TPU粒子的含水量在200ppm (0.02%)以下。
- 2. 本公司TPU粒子形狀有兩種，一種為米粒形粒子 (Rice-like Shape)，字尾標示為10，另一種為圓柱形粒子 (Cylindrical Shape)，字尾標示為20。
- 3. 良好的包裝，其靜置期 (Shelf Life) 約為1年，但TPU為易吸濕及水解的材料，最好在出廠2年內成型完畢且應儲存在陰涼乾燥，遠離陽光處。

● Post-Treatment

- 1. The post-treatment can get the optimal and stable mechanical properties for TPU. Such process is required for some high-performance finished products and the item that needs to know the property result immediately.
- 2. Listed in Table 2 are the recommended post-treatment conditions.
- 3. By exposing the injection or extrusion finished products at 25°C for about 4~5 weeks, the mechanical properties that obtained are very close to that obtained from the post-treatment.

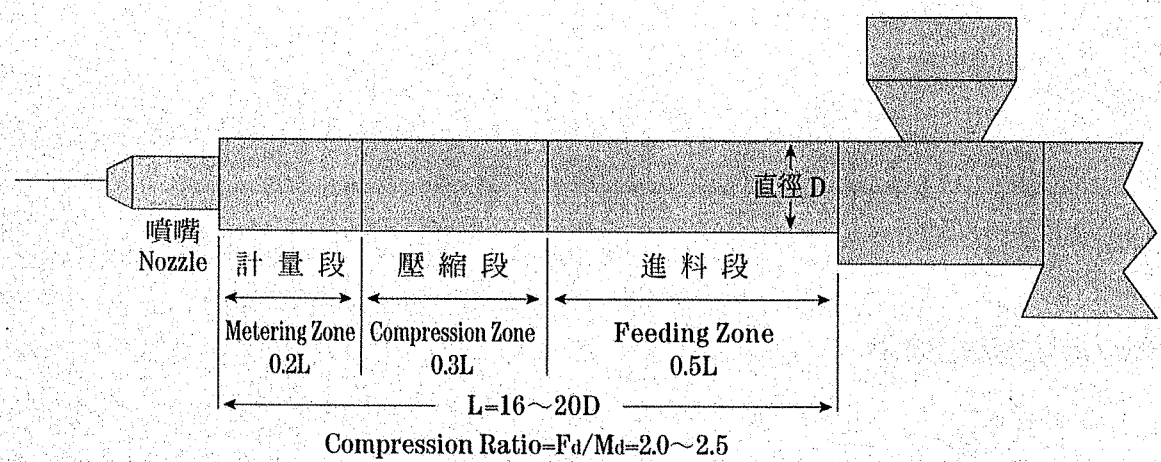
● Processing Surrounding and Environmental Protection Suggestions

Same as general plastics, the Utechllan® TPU tends to decompose above certain temperature. When the smoke is produced during processing the fully dried TPU pellets, it means the TPU raw material has already been decomposed. Normally, the Utechllan® TPU starts to decompose slowly upon reaching 230°C and so the operation room must be equipped with effective ventilation and air discharge equipment. The Utechllan® TPU will not contaminate the environment and the waste that cannot be processed any longer can be disposed in ordinary landfill site or incineration plant, except that the environmental protection regulations must be observed.

● Package & Storage

- 1. Our TPU pellets is packed in 25kgs multi-layer paper Al bag for loading in the PE film. The water content of the original TPU pellets is below 200ppm (0.02%).
- 2. Our TPU pellets shape is available in two types. One of them is rice-like shape, the suffix is marked as 10 and the other, cylindrical shape which is marked as 20 on the suffix.
- 3. The shelf life of well-sealed package TPU should be around 1 year. Because TPU is a kind of material that is easy to moisture absorption and hydrolysis, so it is recommended to have them molded within 2 years after the TPU has been produced and be stored in a ventilated, dry and away from sunshine.

UTECHELLan 的射出成型介紹 (Injection Molding)



● 射出成型機 (Injection Molding Machine)

如上圖所示，一般單螺桿(Single-Screw)三段式的射出機適合於TPU的射出；與其他塑膠相比，由於TPU在融熔時具有高黏度，在料管裡(Screw Barrel)容易產生高剪切力(Shear Stress)而破壞TPU本身的物性，所以一般選擇螺桿長度L/D比16~20左右，壓縮比(Compression Ratio)約為2.0~2.5最適合TPU的射出。

● 射出加工溫度 (Injection Temperature)

建議的射出加工溫度如《附表3》，但依成品的大小尺寸及肉厚，射出機大小而酌予調整。

《附表3》《Table 3》 噴嘴 計量段 壓縮段 進料段

溫度 Temp 硬度 Hardness	機械段 Zone	噴嘴 (Nozzle)	計量段 (Metering Zone)	壓縮段 (Compression Zone)	進料段 (Feeding Zone)
Shore 60A~80A		170~195°C	160~185°C	155~180°C	150~175°C
Shore 85A~98A		195~215°C	185~205°C	180~200°C	175~195°C
Shore 60D~71D		215~225°C	205~215°C	200~210°C	195~205°C

※註：若欲加工UTX、UTC系列透明規格，則加工溫度調低約10~15°C。

Note: In working with UTX or UTC transparent grades, the injection temperature should be lowered for 10~15°C.

● Injection Molding Machine

As shown in the above figure, the single-screw 3-section injection machine is more suitable for the TPU injection. Comparing to other plastics, it tends to produce high shear stress in the screw barrel owing to the high viscosity during melting so as to damage the properties of TPU. Therefore, the screw having L/D ratio around 16~20 and compression ratio around 2.0~2.5 is selected for using in the injection of TPU.

● Injection Temperature

Shown in Table 3 is the recommended injection temperatures which will be adjusted according to the size, thickness of the finished components and the dimension of injection machine.

● **模溫 (Mold Temperature)**

一般保持在常溫25°C至45°C即可，若爲了某些目的，如加工透明規格，可以冷水通模具內部管路，保持模具溫度約在10°C左右，以達到透明及減少冷卻時間效果。

● **縮水率 (Shrinkage)**

1. 由於TPU是由單體定量合成而成，且其在融熔時爲半黏稠膠質，所以其縮水率易受到成品設計(如入口點、肉厚、形狀)及射出條件(溫度、保壓、射壓、模溫)的影響而改變，所以欲十分精確地預測射出部品的縮水率是相當困難。
2. 下列的各規格的縮水率可以爲模具設計的參考《如附表4》

《附表4》《Table 4》

規格 (Grades)	縮水率% (Shrinkage)	規格 (Grades)	縮水率% (Shrinkage)
U-85A~U-90A	1.4~1.6	UTX-95A	3.3
U-95A~UH-71D	0.8~1.2	UTX-60D~UTX-71D	2.1~2.6
UF-85A~UF-90A	1.4~1.6	UTY-85A~UTY-95A	2.9~3.7
UF-95A~UF-64D	1.0~1.2	UTY-98A~UTY-60D	2.3~2.5
U-75AP~U-85AP	1.6~2.0	UTY-64D~UTY-71D	1.9~2.2
UB-90A~UB-60D	1.1~1.4	UTC-85A~UTC-90A	3.7~3.9
UE-60A~UE-70A	2.5~2.6	UTC-95A~UTC-98A	2.5~3.0
UE-80A~UE-90A	1.5~1.7	UTC-60D~UTC-64D	2.1~2.3
UE95A~UE-71D	0.8~1.2	US-60A~US-70A	2.5~2.6

註：試片長度 115mm，寬25mm，厚2mm在流動方向所量得的縮水率。

Note: The shrinkage is measured in the flowing direction of the tested piece.

The size of tested piece is 115mm (L) x 25mm (W) x 2mm (T).

● **Mold Temperature**

Normally, it is recommended to maintain the mold temperature between 25°C and 45°C. For some special purposes, e.g. processing the transparent grades, the cold water can be flowed through the pipeline inside the mold to keep the mold temperature at around 10°C so as to achieve transparency and reduce cycle time.

● **Shrinkage**

1. As TPU is obtained through the monomers quantitative polymerization process and it would become semi-sticky gel type when melted, its shrinkage is easy to change by the finished product designed (e.g. gate, thickness and shape) and injection conditions (injection temp., injection pressure and mold temp.). Therefore, it would be very difficult to precisely estimate the shrinkage of finished product.
2. The shrinkage of the Table 4 grades can be used as a reference of the mold design.

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◎ 乾燥 (Pre-Drying)

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2. 由於TPU易吸濕及易水解特性，未充分乾燥的TPU原料易導致加工困難，射出品表面不良及成品物性的降低，所以在成型前必須先把TPU原料充分乾燥至含水量200ppm(0.02%)以下。
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U-95A UE-95A

《附表1》
《Table 1》

Water Content 含水量 時間 Time	Grade 規格	U-95A	UE-95A
	4 hrs		0.10 wt%
24 hrs		0.25 wt%	0.35 wt%

5. 無論傳統的循環氣體乾燥箱 (Circulating Air Hopper) 或除濕乾燥機 (Dehumidifier) 皆可用來乾燥TPU，建議的乾燥條件如下：

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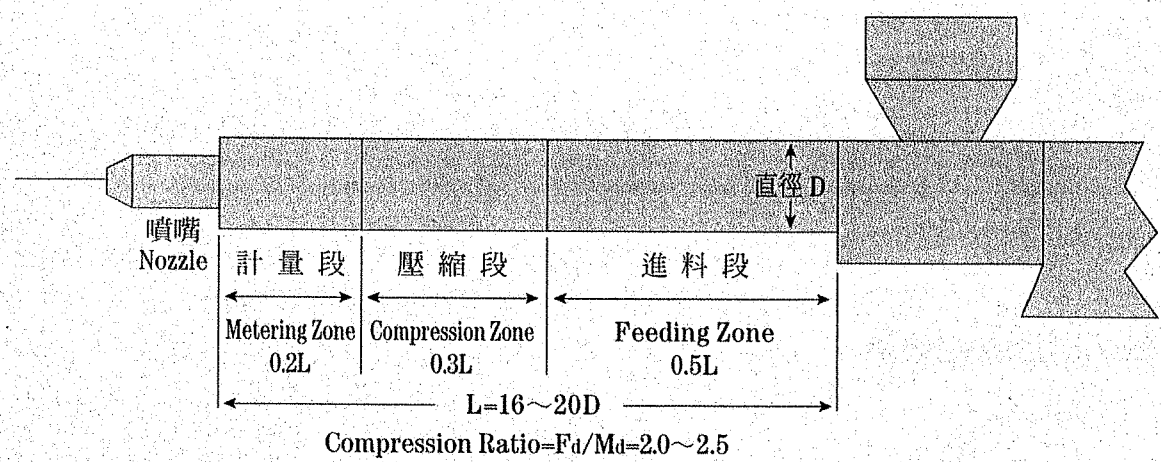
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※註：若欲加工UTX、UTC系列透明規格，則加工溫度調低約10~15°C。

Note: In working with UTX or UTC transparent grades, the injection temperature should be lowered for 10~15°C.

● Injection Molding Machine

As shown in the above figure, the single-screw 3-section injection machine is more suitable for the TPU injection. Comparing to other plastics, it tends to produce high shear stress in the screw barrel owing to the high viscosity during melting so as to damage the properties of TPU. Therefore, the screw having L/D ratio around 16~20 and compression ratio around 2.0~2.5 is selected for using in the injection of TPU.

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2. 下列的各規格的縮水率可以爲模具設計的參考《如附表4》

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U-95A~UH-71D	0.8~1.2	UTX-60D~UTX-71D	2.1~2.6
UF-85A~UF-90A	1.4~1.6	UTY-85A~UTY-95A	2.9~3.7
UF-95A~UF-64D	1.0~1.2	UTY-98A~UTY-60D	2.3~2.5
U-75AP~U-85AP	1.6~2.0	UTY-64D~UTY-71D	1.9~2.2
UB-90A~UB-60D	1.1~1.4	UTC-85A~UTC-90A	3.7~3.9
UE-60A~UE-70A	2.5~2.6	UTC-95A~UTC-98A	2.5~3.0
UE-80A~UE-90A	1.5~1.7	UTC-60D~UTC-64D	2.1~2.3
UE95A~UE-71D	0.8~1.2	US-60A~US-70A	2.5~2.6

註：試片長度 115mm，寬25mm，厚2mm在流動方向所量得的縮水率。

Note: The shrinkage is measured in the flowing direction of the tested piece.

The size of tested piece is 115mm (L) x 25mm (W) x 2mm (T).

● Mold Temperature

Normally, it is recommended to maintain the mold temperature between 25°C and 45°C. For some special purposes, e.g. processing the transparent grades, the cold water can be flowed through the pipeline inside the mold to keep the mold temperature at around 10°C so as to achieve transparency and reduce cycle time.

● Shrinkage

1. As TPU is obtained through the monomers quantitative polymerization process and it would become semi-sticky gel type when melted, its shrinkage is easy to change by the finished product designed (e.g. gate, thickness and shape) and injection conditions (injection temp., injection pressure and mold temp.). Therefore, it would be very difficult to precisely estimate the shrinkage of finished product.
2. The shrinkage of the Table 4 grades can be used as a reference of the mold design.