

【Phrozen樹脂 使用者指南】

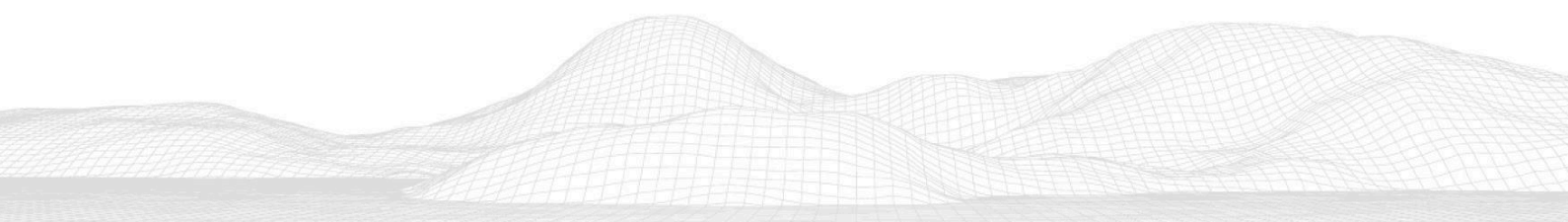
工程樹脂：阻燃料，灰色

大綱

在列印一個理想的物件前，我們可以先了解材料在各條件下能完整列印出物件的極限在哪；因此Phrozen提供以下設計建議，幫助您列印物件時大幅提升成功率，並印製出更符合您心目中的物件。


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Section 1

TDS

General Properties	Norm	Typical values	
Appearance	-	Gray	
Viscosity, 30	Cone/Plate Rheometer ¹	180-285 mPas	
Density (liquid resin)	ASTM D4052-18a	1.14 g/cm ³	
Tensile Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
E Modulus	ASTM D638	1812 MPa	1537 MPa
Ultimate Tensile Strength	ASTM D638	28.5 MPa	38.1 MPa
Elongation at Break	ASTM D638	3.8 %	4.9 %
Impact Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
Notched Izod (Machined), 23 °C	ASTM D256	30.7 J/m	17.5 J/m
Thermal Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
HDT at 0.45 MPa	ASTM D648	59.8 °C	82.8 °C
Hardness	Norm	Typical values	
		UV post-cured	UV +Thermal
Shore D	ASTM D2240	75-80D	82D
Flammability	Norm	Typical values	
V-0 Burning stops within 10 seconds on a vertical specimen; drips of particles are allowed as long as they are not inflamed.	UL94 V-0	3.0-3.3mm	
			

* 除了UL Test 是以Sonic Mini 4K列印,其他所有的性能測試都是以Phrozen Sonic Mighty 8K 或 Sonic Mini 8K列印,並使用 Phrozen Cure & Wash做清洗及二固。

- * 照光二固化之後額外再加熱80°C 持續2小時。
- * 固化時間拉長可提升機械性能,但也將增加不規則形變的機率。

Specimens are printed unless stated otherwise. The information in this TDS, including product recommendations, is based on our current knowledge and experience. Descriptions, drawings, photographs, data, proportions, weights, etc. provided may change without notice and do not establish the product's contractual quality. Request the relevant MSDS from your supplier or contact Phrozen Tech Co., Ltd at sales@phrozen3d.com

Section 2

UL藍卡

iq.ul.com

Plastics for Additive Manufacturing

Guide Information

[View Certificate of Compliance](#)

E535425

PHROZEN TECH CO LTD

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Phrozen-FR940 (#)

Process Category: VAT Polymerization - Liquid Crystal Display (LCD)
Acrylic, furnished as Liquid

Color	Min. Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
GY	3.0-3.3	V-0	-	-	50	50	50

Comparative Tracking Index (CTI): -	Inclined Plane Tracking (IPT) kV: -
Dielectric Strength (kV/mm): -	Volume Resistivity (10 ^x ohm-cm): -
High-Voltage Arc Tracking Rate (HVTR): -	Surface Resistivity (10 ^x ohms/square): -
Dimensional Change (%): -	High Volt, Low Current Arc Resis (D495): -

Processing Parameters

Build Plane: Horizontal & Vertical

Layer Thickness (mm): 0.05-0.1

Post Processing Method: Please see footnote (#)

For use with printer: Phrozen Sonic Mini 4K

Limited properties and ratings assigned to samples produced by the Additive Manufacturing technique representing a specific set of printing parameters and build strategy. Other print parameters and build strategies may result in significantly different results.

(#) - Soak object in Phrozen Wash with 95% alcohol for 45-60 seconds. Remove to well-ventilated area for min 30 minutes or gently use compressed air to dry the object with no exposure to light. Use post-curing equipment (Phrozen Cure & Wash/Phrozen Cure/ Phrozen Mega Cure) or other post-curing lamps with the same wavelength to cure for 30 minutes.

IEC/ISO small-scale test data does not pertain to building materials, furnishings and related contents. IEC/ISO small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

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Last Revised: 2023-11-01

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	3.0-3.3	V-0 (GY)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	°C	-	-
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	°C	-	-
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC AC Dielectric Strength (AC DS)	IEC 60243-1	kV/mm	-	-
IEC DC Dielectric Strength (DC DS)	IEC 60243-2	kV/mm	-	-
IEC Volume Resistivity (VR)	IEC 62631-3-1	10 ^x ohm-m	-	-
IEC Surface Resistivity (SR)	IEC 62631-3-2	10 ^x ohms	-	-
IEC Inclined Plane Tracking (IPT)	IEC 60587	kV	-	-
IEC Ball Pressure	IEC 60695-10-2	°C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	°C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m ²	-	-
ISO Izod Impact	ISO 180	kJ/m ²	-	-
ISO Charpy Impact	ISO 179-1	kJ/m ²	-	-

Section 3

列印

列印參數

測試機台	Sonic mini / Sonic mini 4K
Layer Height	50μm
Exposure Time	1.5-2 s
Bottom Exposure Time	30-40 s
Light-off Delay	12 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

測試機台	Sonic Mini 8K
Layer Height	50μm
Exposure Time	2.5-3 s
Bottom Exposure Time	30-40 s
Rest Time After Retract	3 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

測試機台	Sonic Mini 8K S
Layer Height	50μm
Exposure Time	1.5-2 s

Bottom Exposure Time	10-15 s
Rest Time After Retract	3 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

測試機台	Sonic Mighty 4K
Layer Height	50μm
Exposure Time	2.5-3 s
Bottom Exposure Time	30-40 s
Light-off Delay	12 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

測試機台	Sonic Mighty 8K
Layer Height	50μm
Exposure Time	2.5-3 s
Bottom Exposure Time	30-40 s
Rest Time After Retract	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

測試機台	Sonic Mighty 12K(升級套件)
Layer Height	50μm
Exposure Time	2.5-3 s
Bottom Exposure Time	30-40 s
Rest Time After Retract	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

測試機台	Sonic Mega 8K*
Layer Height	50 μm
Exposure Time	30-40 s
Bottom Exposure Time	2.5-3.5 s
Rest Time After Retract	3 s
Lift Distance	8 mm
Lifting Speed	45 mm/min

測試機台	Sonic Mega 8K S
Layer Height	50 μm
Exposure Time	15-20 s
Bottom Exposure Time	1.5-2 s
Rest Time After Retract	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

* Mega 8K 因拉拔力較大, 須提高固化秒數以增加列印成功率

* 印時務必蓋上遮光罩, 以維持樹脂最佳列印狀態

清洗、靜置

1. 建議使用Phrozen 後處理設備:「Phrozen Cure & Wash」
2. 使用 Phrozen Wash 水流機, 添加95%酒精, 清洗45-60秒。**請勿在酒精或其他溶劑 (例IPA) 浸泡超過60秒, 有可能傷害物件表面**
3. 空心薄件請務必洗淨內部
4. 清洗後靜置30分鐘即可二固

***薄件貼底印製時請小心鏟下, 有可能讓模型變形**

二固

1. 建議使用Phrozen 二固化設備:「Phrozen Cure & Wash」、「Phrozen Cure」、「Phrozen Mega Cure」等
2. 二固化時間 30-60分鐘。

Section 4

設計規格

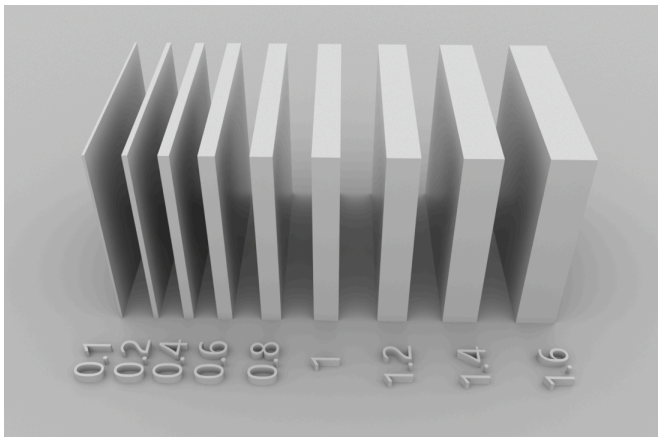
※註: 所有指標均為樹脂之極限值, 會依照使用機台不同有所差距※

Minimum Unsupported Wall Thickness

最小無支撐壁厚

此項指標為在無支撐前提下能獨立印出且無彎曲、斷裂現象之最薄厚度。

建議厚度: ≥ 0.4 mm

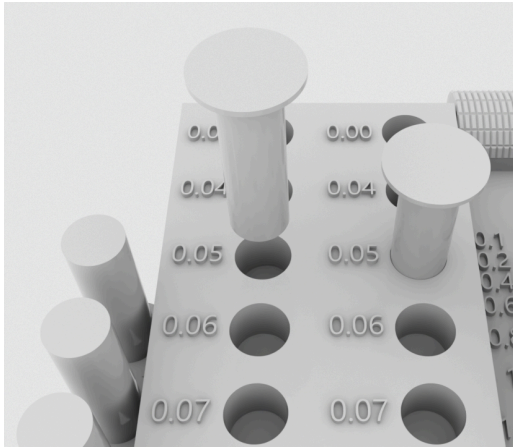


Size Tolerance, X-Y plane

最小尺寸公差

此項指標為平行於XY平面上的孔洞與立柱接合之最小尺寸公差。

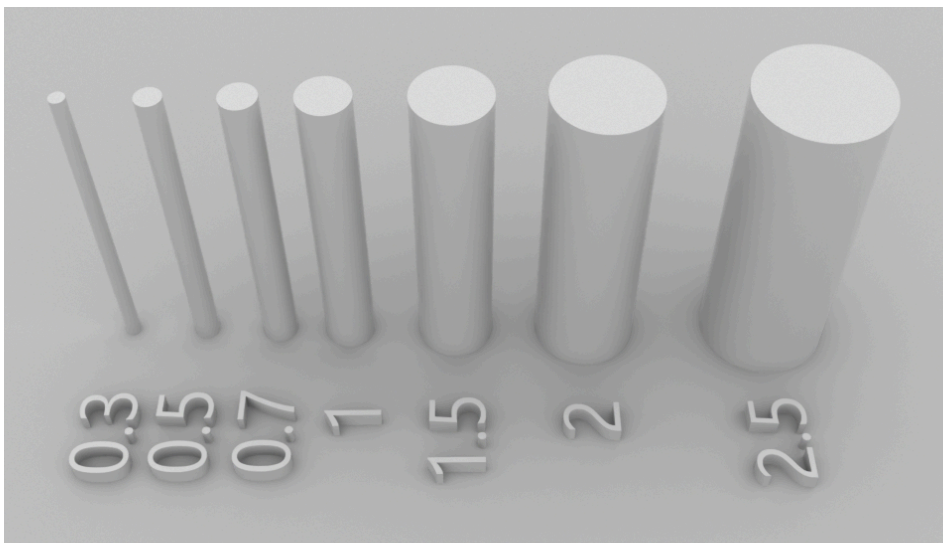
建議公差: ≥ 0.2 mm



Minimum Pin Diameter

最小立柱直徑

此項指標為細根及支撐能獨立印出且無彎曲、斷裂現象之最小立柱直徑。
建議直徑: ≥ 0.7 mm

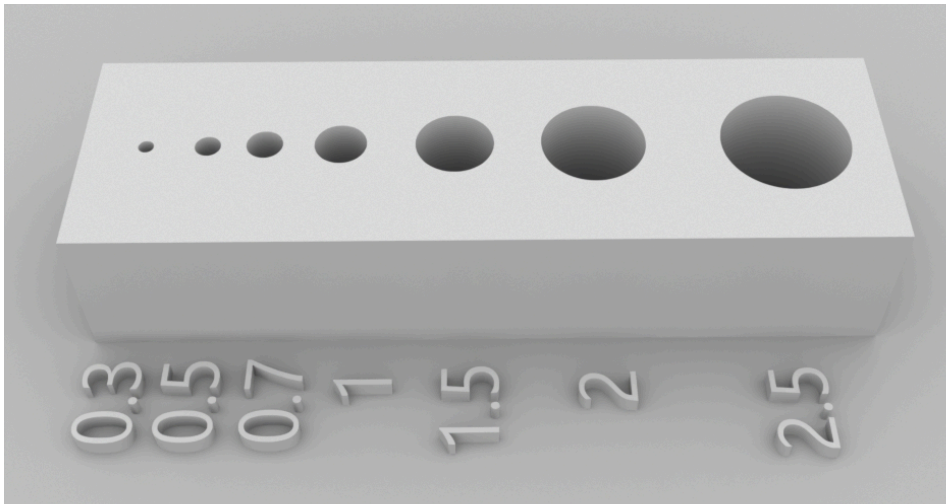


Minimum Hole Diameter, X-Y plane

最小孔洞直徑

此項指標為平行於XY平面列印前提下能完整印出之最小孔洞直徑。

建議直徑: ≥ 1 mm



Minimum Embossed Detail Width, X-Y plane

最小浮雕細節寬度

此項指標為可完整列印浮雕細節之最低線條寬度
建議寬度: ≥ 0.1 mm

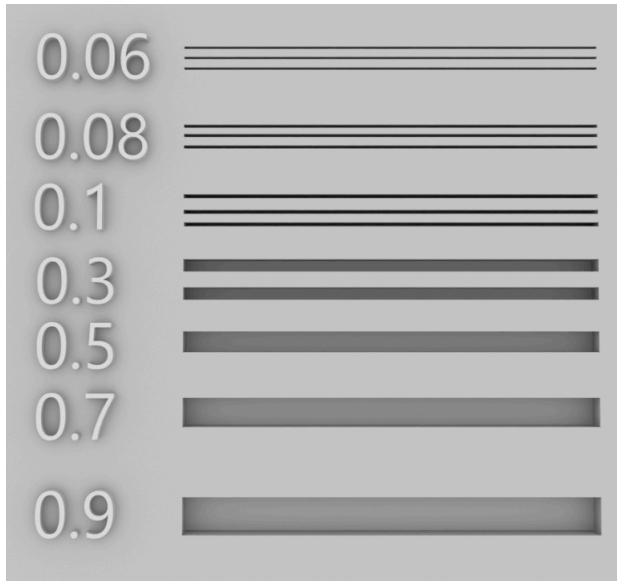


Minimum Engraved Detail Width, X-Y plane

最小雕刻細節寬度

此項指標為可完整列印雕刻細節之最低線條寬度

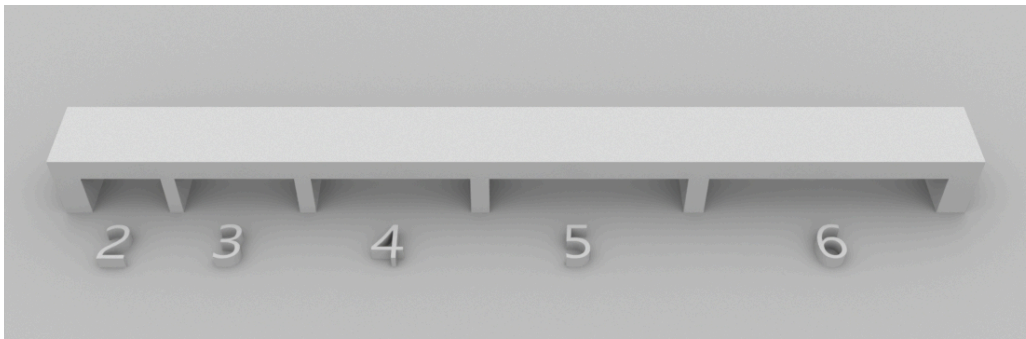
建議寬度: ≥ 0.5 mm



Maximum Horizontal Bridge Span

最大水平跨橋寬度

此項指標為在兩側有支撐壁前提下能印出不變形懸空模型之支撐壁間最大寬度。
建議寬度: ≤ 6 mm



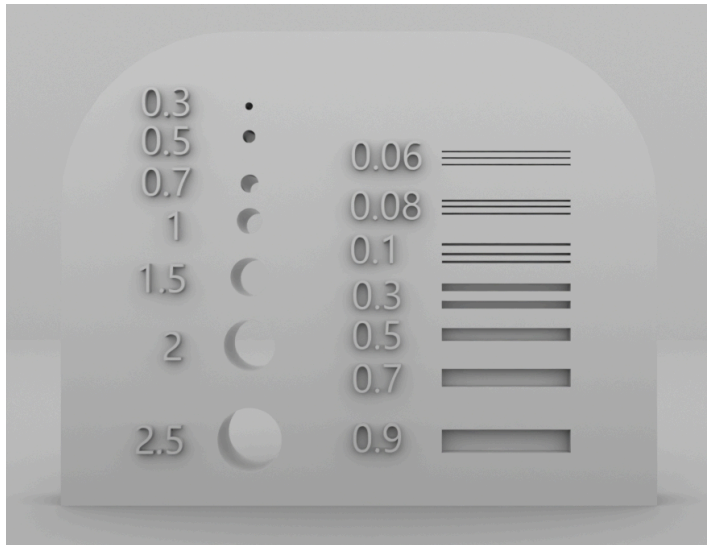
Minimum Hole Diameter and Engraved Detail Width, Z-axis, at 0.05mm layer height

Z軸最小孔洞直徑及最小雕刻凹槽寬度 (0.05mm層高)

此項指標為再層厚為0.05mm時Z軸上可完整印出之最小孔洞直徑及最小雕刻凹槽寬度

建議直徑: ≥ 0.7 mm

建議寬度: ≥ 0.3 mm



Section 5

應用範例

