SYNTHOSOL™ P250

SYNTHOSOL™ is a unique, specially formulated, cold water-soluble material based on polyvinyl alcohol intended for thermal extrusion applications.

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SYNTHOSOL™ is a market-leading product with key benefits for 3D printing:

- Efficient cold water solubility in tap water
- Excellent thermal stability for high temperature printing
- Extended printing temperature range facilitating compatibility with a broad range of materials
- Inherently biodegradable (OECD 302B), microplastic free formulation
- Non-toxic, non-hazardous product and waste
- Developed and manufactured in the UK

Property	Typical Value	Unit	Method[1]
Adhesion	Good adhesion to a variety of build materials		
Melt Flow Index	<1.0	g/10 min	
Appearance	Natural amber colour with no bubbles		
Specific gravity	0.76	g/cm3	
Glass transition temperature [Tg]	60 - 65	°C	
Residual Moisture Content	<0.4%		
Melting temperature (Tm)	160	°C	
Total Solids Content (TSC)	>99.5	%	

[1] internal method based upon the specified norm

Standard product form: 2 - 4mm pellets

Application Advice - 3D Printing

SYNTHOSOL™ P250 is versatile fully formulated product that can be used directly for Fused Granular Fabrication (FGF) or further processed into filament for use within Fused Filament Fabrication (FFF) additive manufacture.

SYNTHOSOL™ is a specially formulated cold water-soluble material based on polyvinyl alcohol. It can be fully dissolved in cold tap water and is typically used as a support material for additive manufacturing to achieve maximum freedom in object design. It is commonly used as a water-soluble support material in 3D printing but it has a wide range of uses including sacrificial tooling and temporary structure applications.

SYNTHOSOL™ is non-toxic and inherently biodegradable (tested to OECD 302B). It is easy and safe to dispose of in regular tap water.

Drying conditions:

It is important to note that it is recommended that the moisture content of SYNTHOSOL™ P250 pellets is measured before drying.

In most cases, a moisture content of 0.4 - 0.6% is acceptable for filament manufacture and printing. If no moisture analyser is available, the Total Solids Content (TSC) can be measured using the following method:

TSC/Moisture Content Method

All measurements are to be carried out in duplicate.

1.Set oven to 120 ± 5°C.

2. Accurately weigh an empty aluminium foil dish (M1).

3. Add approximately 1-2 g of pellets and record the total mass (sample + aluminium foil dish) (M2)

4. Place foil dishes in the oven and keep for 1 hour

5. Remove the foil dish from the oven, allow to cool and record the dry mass (M3)

6. TSC can be calculated: TSC (%)= ((M3-M1)/(M2-M1))*100

Using this method a TSC of 99.4 - 99.6% is targeted which is equivalent to a moisture content of 0.6 - 0.4%.**The pellets should be dried before use if moisture content is >0.6%**

Drying Method:

It is recommended that moisture content of SYNTHOSOL™ P250 pellets is measured regularly

during the drying process to prevent over drying. Over drying will negatively affect print performance and solubility.

The minimum drying time should be chosen for optimum print performance. Drying speed will vary with each set up, however it is advised that the recommended conditions are not exceeded.

It is advised that only enough pellets are dried to complete the print.

Recommended drying conditions:

Drying Temperature: 50-60ºC (60ºC max)

Drying Time: 1-5 hours with TSC monitoring

Apparatus: oven or specialist polymer/pellet dryer

Ensure pellets are dried evenly. If using an oven, spread pellets on trays. If using a polymer dryer, fill to a capacity that ensures good mixing and air flow.

For additional support for drying please contact 3dprinting@synthomer.com

Printing from Pellets

This guidance is for FGF printing of SYNTHOSOL™ P250 pellets. Printing parameters vary across different printer systems (enclosed systems, dual extrusion, active cooling, heated chambers etc) so this information should be treated as guidance only.

Pellets should be dry before use, moisture content should be measured as outlined in the ‘Drying Conditions’ section of this document.

Nozzle temperature: 220-250ºC

Bed temperature: Room Temperature - 80ºC

Chamber temperature (if required): 60ºC max

SYNTHOSOL™ can achieve long layer times for large builds if required and is suitable for a variety of nozzle sizes (tested: 0.8, 4 & 5mm).

SYNTHOSOL™ can be printed on a variety of build plates including glass, PC, magnetic beds. Adhesives can be used to improve adhesion if required for the print.

Filament Extrusion Guidance

The following guidance conditions for producing filament from SYNTHOSOL™ P250 pellets are recommended:

• Dry pellets to 99.4 - 99.6% Total Solids Content via the method outlined in the 'Drying Conditions' section of this document

• Ensure filament extrusion line is set up without any water baths, only air cooling should be used for this product

Filament can be produced under the following conditions on a 3Devo Composer 350 desktop filament maker:

1.75 mm filament diameter

Melt zones set temperatures: (hopper)160/187/189/183°C (nozzle)

Screw speed: 5.7rpm

Cooling fan: 10-30%

Retention time: 4 minutes

2.85 mm filament diameter

Melt zones set temperatures: (hopper)160/187/188/183°C (nozzle)

Screw speed: 6.5-6.7rpm

Cooling fan: 10-30%

Retention time: 4 minutes

Printing from Filament

The following print conditions are recommended for guidance to print with SYNTHOSOL™ P250. These are the conditions achieved in conjunction with filament produced as directed in the 'Filament Extrusion Guidance' section of this document.

These conditions were achieved on an Ultimaker S3 printer:

Nozzle Diameter	0.4/0.6/0.8 mm
Cooling fan speed	Dependent on print and nozzle print temperature
Bed Temperature	RT-80 °C (based on build material)
Nozzle temperature	230-260 °C , optimum 240°C
Flow rate	100-110%

Printing speed	20-40 mm/s
Build plate	Glass
Build plate adhesive	Yes

It is recommended to check SYNTHOSOL™ filament for moisture before printing. Bubbling/foaming during printer set up would indicate moisture and it is advised to dry the filament spool.

When extruder operation is stopped, it is recommended to clean the nozzle to prevent any blockage. Typical materials which may be used to purge the extruder are PLA and HDPE.

Contact the team at 3dprinting@synthomer.com for additional guidance.

Removal Guidance

SYNTHOSOL™ P250 can be removed from printed parts in cold water.

The following conditions for dissolution of SYNTHOSOL™ are recommended:

• Cold water (SYNTHOSOL™ readily dissolves in cold tap water)

• Ensure that a large volume of water is used. The larger the water volume, the faster SYNTHOSOL™ will dissolve. If this is not achievable, frequent water changes are recommended.

• Agitation of the water is advised.

• SYNTHOSOL™ can be manually removed after 30-60 mins soaking. To speed up dissolution on prints that use a significant quantity of support externally, manual removal is recommended for faster post processing.

Dissolution rate can be sped up by:

• Frequent water changes

• A larger volume of water to print part ratio

• More agitation

• Pre-soaking and breaking away any support that is accessible externally

• Print support as a lattice pattern to maximise water penetration on the printed part, for example, 20% Infill Density.

SYNTHOSOL™ P250 can be used as a breakaway support if the material is pre-soaked first. SYNTHOSOL™ readily absorbs water and swells - depending on the size of the part and the geometries printed, a 30-60 minute soak in cold water enables manual removal from the print.

Material Compatibility

SYNTHOSOL™ P250 is compatible with a broad range of printing materials including PLA, ABS, Nylon, PETG and PP. SYNTHOSOL™ demonstrates good compatibility with composite materials such as wood filled and carbon fibre filled.

For improved adhesion properties, print speed can be slowed at the material interfaces.

Our labs are continuously approving new materials for use with SYNTHOSOL™ so for further advice regarding material compatibility please contact 3dprinting@synthomer.com

Shipping and Storage

Store in metallised foil packaging to prevent the moisture ingress. Re-seal after use.

As supplied, the product should remain fit for use for 12 months from the date of manufacture. SYNTHOSOL™ is supplied in 20kg sealed metallised foil bags and each bag contains the batch number and net weight. May be available in smaller pack sizes upon request.

Product Safety

Before handling, please read the Safety Data Sheet of this product for advice on safety, use and disposal.