Technical Data Sheet

Ultrasint® TPU01
for HP Jet Fusion Printers

Technical Data Sheet for Ultrasint® TPU01 | Version No.: 3.2, revised 08/2021

General information

Components

Thermoplastic polyurethane powder for HP Jet Fusion Printers

Product Description

Ultrasint® TPU01 is a multi-purpose material for application in Multi Jet Fusion. Parts produced with this material offer a balanced property profile with good flexibility, shock absorption and the possibility to print very fine structures with a high level of detail. In addition, the material is easy to print, and has good UV and hydrolysis resistance. Ultrasint® TPU01 is only processable in HP Multi Jet Fusion printers.

Typical applications are:

- Sports & Leisure
- Footwear
- Transportation Industry
- Jigs & Fixtures

Delivery Form & Warehousing

Ultrasint® TPU01 should be stored at 15 – 35°C in its originally sealed package in a clean and dry environment.

Product Safety

Mandatory and recommended industrial hygiene procedures and the relevant industrial safety precautions must be followed whenever this product is being handled and processed. Product is sensitive to humid environment conditions. For additional information please consult the corresponding material safety data sheets.

For your Information

Ultrasint® TPU01 comes in white color. Chemical properties (e.g. resistance against particular substances) and tolerance for solvents are available upon request. Generally, these properties correspond to publicly available data on polyurethanes.

Notice

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

The safety data given in this publication is for information purposes only and does not constitute a legally binding Material Safety Data Sheet (MSDS). The relevant MSDS can be obtained upon request from your supplier or you may contact Forward AM directly at sales@basf-3dps.com.

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General Properties	Test Method	Typical Values
Bulk Density / g/cm³	DIN EN ISO 60	0.5
Printed Part Density / g/cm³	DIN EN ISO 1183-1	1.1
Mean Particle Size d50 / µm	ISO 13320	70-90
Glass Transition Temperature / °C	ISO 11357 (20 K/min)	- 48
Melting Temperature / °C	ISO 11357 (20 K/min)	120-150

Thermal Properties	Test Method	Typical Values[1] X-Direction	Typical Values[1] Z-Direction
UL Flammability	UL 94	HB (1.6-4.2 mm)	HB (1.6-4.2 mm)
Vicat/A (10 N) / °C	DIN EN ISO 306	97	98

Skin Contact	Test Method	Typical Value
Cytotoxicity	ISO 10993-5 (2009)	Pass
In vitro Skin Irritation Testing	OECD Guideline No. 439	Pass
In vivo Sensitization Testing	ISO 10993-10 (2013), OECD Guideline No. 429	Pass

Mechanical Properties	Test Method	Typical Values[1] X-Direction	Typical Values[1] Z-Direction
Hardness Shore A	DIN ISO 7619-1	88-90	88-90
Tensile Strength / MPa	DIN 53504, S2	9	7
Tensile Elongation at Break / %	DIN 53504, S2	280	150
Tensile Modulus / MPa	ISO 527-2, 1A	85	85
Flexural Modulus / MPa	DIN EN ISO 178	75	75
Tear Resistance (propagation, Trouser) / kN/m	DIN ISO 34-1, A	21	18
Tear Resistance (initiation, Graves) / kN/m	DIN ISO 34-1, B	38	32
Compression Set B (23°C, 72h) / %	DIN ISO 815-1	23	24
Rebound Resilience / %	DIN 53512	63	63
Abrasion Resistance / mm³	DIN ISO 4649	96	100
Charpy Impact Strength (notched, 23°C) / kJ/m²	DIN EN ISO 179-1	No break	No break
Charpy Impact Strength (notched, -10°C) / kJ/m²	DIN EN ISO 179-1	46	44
Fatigue Behavior (Rossflex, 100k cycles, 23°C)	ASTM D1052	No cut growth	
Fatigue Behavior (Rossflex, 100k cycles, -10°C)	ASTM D1052	No cut growth	

Detailed material data and support for FEA simulations available on request (sales@basf-3dps.com).

1) Measured after conditioning 3 days at 23°C and 50% r.h.

All values represent the stable part performance obtained when using the recommended refresh rate of 20% fresh + 80% recycled powder.

HP 3D High Reusability PA 12

Strong, lowest cost,[1] quality parts

Produce strong, functional, detailed complex parts

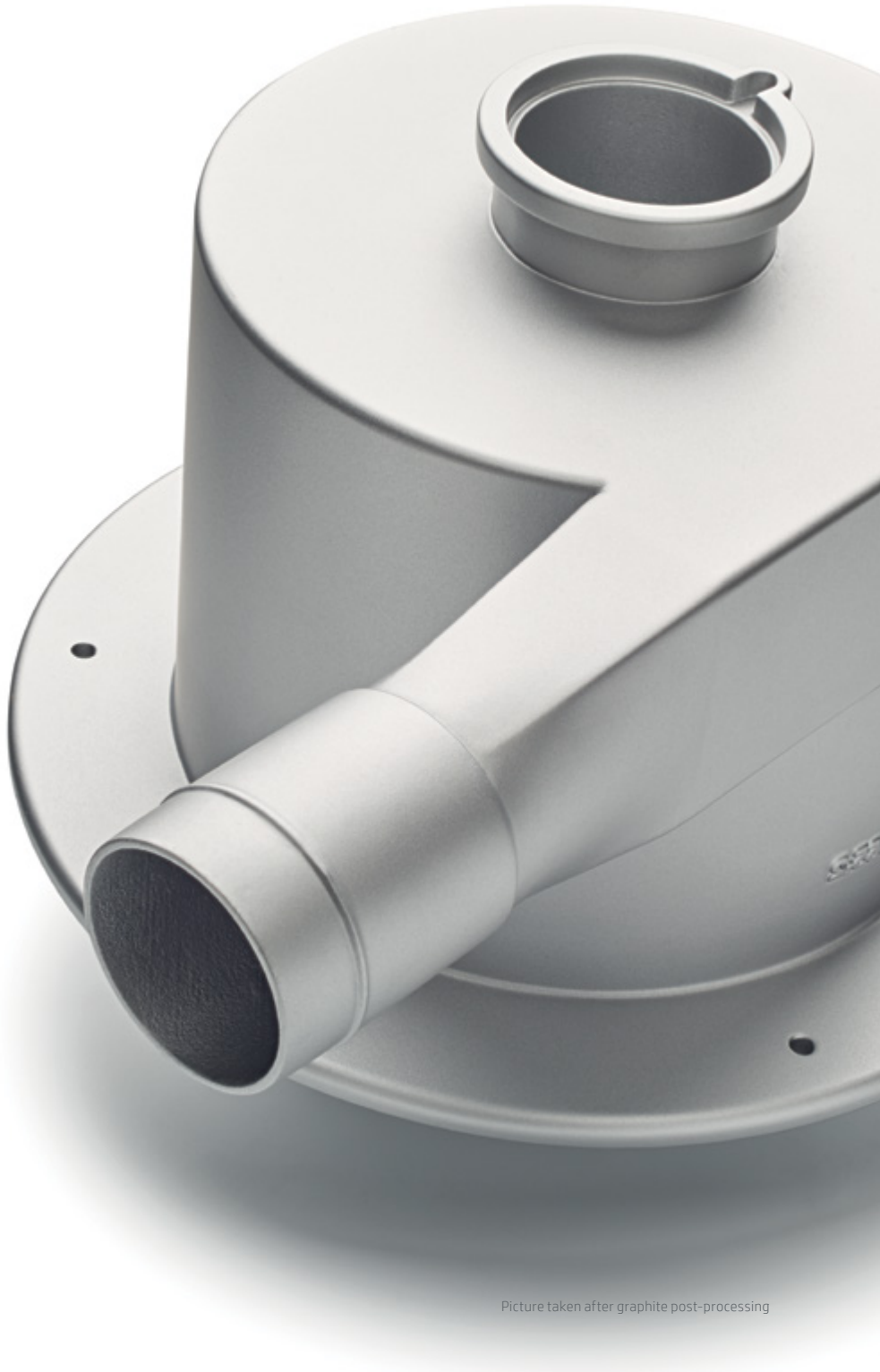
- Robust thermoplastic produces high-density parts with balanced property profiles and strong structures.
- Provides excellent chemical resistance to oils, greases, aliphatic hydrocarbons, and alkalies.[2]
- Ideal for complex assemblies, housings, enclosures, and watertight applications.
- Biocompatibility certifications—meets USP Class I-VI and US FDA guidance for Intact Skin Surface Devices.[3]

Quality at the lowest cost per part[1]

- Achieve the lowest cost per part[1] and reduce your total cost of ownership.[4]
- Minimize waste—reuse surplus powder batch after batch and get functional parts, no throwing away anymore.[5]
- Get consistent performance while achieving 80% surplus powder reusability.[6]
- Optimize cost and part quality—cost-efficient material with industry-leading surplus powder reusability.[5]

Engineered for HP Multi Jet Fusion technology

- Designed for production of functional parts across a variety of industries.
- Provides the best balance between performance and reusability.[7]
- Achieves watertight properties without any additional post-processing.
- Engineered to produce final parts and functional prototypes with fine detail and dimensional accuracy.



Picture taken after graphite post-processing

For more information, please visit
hp.com/go/3DMaterials

Technical specifications[8]

Category	Measurement	Value	Method
General properties	Powder melting point (DSC)	187 °C/369 °F	ASTM D3418
	Particle size	60 µm	ASTM D3451
	Bulk density of powder	0.425 g/cm^3	ASTM D1895
	Density of parts	1.01 g/cm^3	ASTM D792
Mechanical properties	Tensile strength, max load[9], XY	48 MPa/6960 psi	ASTM D638
	Tensile strength, max load[9], Z	48 MPa/6960 psi	ASTM D638
	Tensile modulus[9], XY	1700 MPa/247 ksi	ASTM D638
	Tensile modulus[9], Z	1800 MPa/261 ksi	ASTM D638
	Elongation at break[9], XY	20%	ASTM D638
	Elongation at break[9], Z	15%	ASTM D638
	Flexural strength (@ 5%)[10], XY	65 MPa/9425 psi	ASTM D790
	Flexural strength (@ 5%)[10], Z	70 MPa/10150 psi	ASTM D790
	Flexural modulus[10], XY	1730 MPa/251 ksi	ASTM D790
	Flexural modulus[10], Z	1730 MPa/251 ksi	ASTM D790
	Izod impact notched (@ 3.2 mm, 23ºC), XYZ	3.5 kJ/m^2	ASTM D256 Test Method A
Thermal properties	Heat deflection temperature (@ 0.45 MPa, 66 psi), XY	175 ºC/347 ºF	ASTM D648 Test Method A
	Heat deflection temperature (@ 0.45 MPa, 66 psi), Z	175 ºC/347 ºF	ASTM D648 Test Method A
	Heat deflection temperature (@ 1.82 MPa, 264 psi), XY	95 ºC/203 ºF	ASTM D648 Test Method A
	Heat deflection temperature (@ 1.82 MPa, 264 psi), Z	106 ºC/223 ºF	ASTM D648 Test Method A
Recyclability	Refresh ratio for stable performance	20%	
Certifications	USP Class I-VI and US FDA guidance for Intact Skin Surface Devices, RoHS[11], EU REACH, PAHs		

Ordering Information

	HP 3D High Reusability PA 12	HP 3D High Reusability PA 12 Bundle 12 units	HP 3D High Reusability PA 12
Product Number	V1R10A	V1R15A	V1R16A
Weight	13 kg	156 kg	130 kg
Capacity	30L[12]	360L[12]	300L[12]
Dimensions (xyz)	600 x 333 x 302 mm	600 x 333 x 302 mm	800 x 600 x 1205 mm
Compatibility	HP Jet Fusion 3D 4210/4200/3200 Printing Solution	HP Jet Fusion 3D 4200 Printing Solution	HP Jet Fusion 3D 4210/4200 Printing Solution

Eco Highlights

- Powders and agents are not classified as hazardous[13]
- Cleaner, more comfortable workplace—enclosed printing system, and automatic powder management[14]
- Minimizes waste due to industry-leading reusability of powder[15]

Find out more about HP sustainable solutions at hp.com/ecosolutions

Learn more at
hp.com/go/3DMaterials

1. Based on internal testing and public data, HP Jet Fusion 3D printing solution average printing cost per part on the HP Jet Fusion 3D 4200 Printing Solution is half the cost of comparable fused deposition modeling (FDM) and selective laser sintering (SLS) printer solutions from $100,000 USD to $300,000 USD, when averaged together and not taken individually, in market as of April 2016. Cost analysis based on: standard solution configuration price, supplies price, and maintenance costs recommended by the manufacturer. Cost criteria: printing 1-2 buckets per day/5 days per week over 1 year of 30-gram parts at 10% packing density using the powder reusability ratio recommended by the manufacturer.
2. Tested with diluted alkalies, concentrated alkalies, chlorine salts, alcohol, ester, ethers, ketones, aliphatic hydrocarbons, unleaded petrol, motor oil, aromatic hydrocarbons, toluene, and DOT 3 brake fluid.
3. Based on HP internal testing, June 2017, HP 3D600 Fusing and Detailing Agents and HP 3D High Reusability PA 12 powder meet USP Class I-VI and US FDA's guidance for Intact Skin Surface Devices. Tested according to USP Class I-VI including irritation, acute systemic toxicity, and implantation; cytotoxicity per ISO 10993-5, Biological evaluation of medical devices–part 5: Tests for in vitro cytotoxicity; and sensitization per ISO 10993-10, Biological evaluation of medical devices–Part 10: Tests for irritation and skin sensitization. It is the responsibility of the customer to determine that its use of the fusing and detailing agents and powder is safe and technically suitable to the intended applications and consistent with the relevant regulatory requirements (including FDA requirements) applicable to the customer's final product. For more information, see www.hp.com/go/biocompatibilitycertificate/PA12.
4. Compared to selective laser sintering (SLS) and fused deposition modeling (FDM) technologies, HP Multi Jet Fusion technology can reduce the overall energy requirements needed to attain full fusing and reduce the system requirements for large, vacuum-sealed ovens. In addition, HP Multi Jet Fusion technology uses less heating power than SLS systems for better material properties and material reuse rates, minimizing waste.
5. Based on using recommended packing densities and compared to selective laser sintering (SLS) technology, offers excellent reusability without sacrificing mechanical performance. Tested according to ASTM D638 and MFI test using HDT at different loads with a 3D scanner for dimensional stability. Testing monitored using statistical process controls. Liters refers to the materials container size and not the actual materials volume. Materials are measured in kilograms.
6. HP Jet Fusion 3D printing solutions using HP 3D High Reusability PA 12 provide 80% post-production surplus powder reusability, producing functional parts batch after batch. For testing, material is aged in real printing conditions and powder is tracked by generations (worst case for recyclability). Parts are then made from each generation and tested for mechanical properties and accuracy.
7. Compared to selective laser sintering (SLS) technology. Tested according to ASTM D638 and MFI test.
8. The following technical information should be considered representative of averages or typical values and should not be used for specification purposes. These values refer to a balanced print mode with FW BD5.
9. Test results realized under the ASTM D638 with a test rate of 50mm/min, specimens type V.
10. Test results realized under ASTM D790 Procedure B at a test rate of 13.55 mm/min.
11. RoHS certification for EU, Bosnia-Herzegovina, China, India, Japan, Jordan, Korea, Serbia, Singapore, Turkey, Ukraine, Vietnam.
12. Liters refers to the materials container size and not the actual materials volume. Materials are measured in kilograms.
13. The HP powder and agents do not meet the criteria for classification as hazardous according to Regulation (EC) 1272/2008 as amended.
14. Compared to manual print retrieval process used by other powder-based technologies. The term "cleaner" does not refer to any indoor air quality requirements and/or consider related air quality regulations or testing that may be applicable.
15. Compared to PA 12 materials available as of June, 2017. HP Jet Fusion 3D printing solutions using HP 3D High Reusability PA 12 provide 80% post-production surplus powder reusability, producing functional parts batch after batch.

4AA6-4895EEP, November 2017

This is an HP Indigo digital print.

Data Sheet

Stainless Steel 303 / 1.4305 / X10CrNiS18-9

Alternative Designations

X10CrNiS18-9; X8CrNiS18-9 (ISO) | 303 (AISI) | 303 (SAE) | S30300 (UNS) | Z8CNF18-09 (AFNOR) | 303S31 (BS) | 2346 (SIS) | SUS303 (JIS)

Key Features

High strength • Good machinability • Ductility • Low corrosion resistance

Description

It is an austenitic chromium-nickel stainless steel with sulfur added to its composition. The result is a material with improved machinability, but with reduced corrosion resistance. This material is therefore ideal for use in environments where corrosion is not a major concern, such as in the food processing industry. In terms of its mechanical properties, X10CrNiS18-9 is a fairly tough material. It is also quite ductile, with an elongation at break of around 31%.

Mechanical Properties

Yield strength	351 MPa
Tensile strength	398 MPa
Elongation at break	31%
Hardness	234
Module of elasticity	562 GPa

Physical Properties

Density	323 kg/dm³
Electrical conductivity	3.22 m/Ω · mm²
Coefficient of thermal expansion	42 K-1 · 10-6
Thermal conductivity	13.3 – 31.2 W/m · K
Specific heat capacity	434 J/kg · K

Chemical Composition

Al	-	N	0.11%
Bi	-	Nb	-
C	0.12%	Ni	8 – 10%
Cd	-	O	-
Co	-	P	0.06%
Cr	17 – 19%	Pb	-
Cu	1%	S	0.15%
Fe	-	Si	1%
H	-	Sn	-
Mg	-	Ti	-
Mn	2%	V	-
Mo	-	Zn	-

Reference

Datasheets provided by Xometry contain materials sourced through trusted OEMs, material distributors, and databases. Please visit Materialdatacenter.com for further information on this material.

Delrin®

acetal resin

Delrin® 511P NC010

Delrin® 511P NC010 is a new grade with the improved stability of Delrin® 500P with modifications for more precise moulding (reduced warpage, less shrinkage, fewer voids). Delrin® 511P NC010 has higher tensile strength and flexural modulus than Delrin® 500P.

Property	Test Method	Units	Value
Mechanical			
Yield Stress	ISO 527-1/-2	MPa	73
Yield Strain	ISO 527-1/-2	%	12
Nominal Strain at Break	ISO 527-1/-2	%	25
Strain at Break	ISO 527-1/-2	%	40
Tensile Modulus	ISO 527-1/-2	MPa	3400
Tensile Creep Modulus	ISO 899	MPa	
1h			3000
1000h			1700
Notched Izod Impact	ISO 180/1A	kJ/m2	
-40C			8
23C			8
Notched Charpy Impact	ISO 179/1eA	kJ/m2	
-30C			7
23C			8
Unnotched Charpy Impact	ISO 179/1eU	kJ/m2	
-30C			260
23C			260
Thermal			
Deflection Temperature	ISO 75-1/-2	°C	
0.45MPa			165
1.80MPa			110
1.80MPa, Annealed			115
Melting Temperature	ISO 3146C	°C	178
Vicat Softening Temperature	ISO 306	°C	
50N			160

Contact DuPont for MSDS, general guides and/or additional information about ventilation, handling, purging, drying, etc.

Mechanical properties measured at 23°C (73°F) unless otherwise stated.

030513/990929

Delrin® 511P NC010

Property	Test Method	Units	Value
Flow			
Melt Flow Rate	ISO 1133	g/10 min	
190C, 2.16kg			14
Electrical			
CTI	IEC 60112	V	
1mm			600
Flammability			
Limited Oxygen Index	ISO 4589	%	22
Other			
Density	ISO 1183	kg/m3	1420
Hardness, Rockwell	ISO 2039/2		R120
Humidity Absorption	ISO 62, Similar to	%	
Equilibrium 50%RH			0.2
Water Absorption	ISO 62, Similar to	%	
Saturation, immersed			0.9
Processing			
Melt Temperature Range		°C	210-220
Melt Temperature Optimum		°C	215
Drying Time, Dehumidified Dryer		h	2-4
Drying Temperature		°C	80
Processing Moisture Content		%	<0.2
Hold Pressure Range		MPa	80-100

Contact DuPont for MSDS, general guides and/or additional information about ventilation, handling, purging, drying, etc.

Mechanical properties measured at 23°C (73°F) unless otherwise stated.

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