MATERIALS NEWS 2017
Iberia workshop

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AGILUS30™
POLYJET’S BEST PERFORMING FLEXIBLE MATERIAL WITH EASIER POST-PROCESSING
Use Case: Ultimate Design Verification for Flexible Parts

The Use Case

- Seals and Gaskets
- Over-molding
- Soft-touch parts

The Pain With Current Solutions

- Traditional methods are too complicated and time consuming
- Current materials do not perform

SSYS Use Case Solution

- Better elongation
- Higher tear resistance
- Less sticky to touch
- Easier to clean
AGILUS30 Family Properties
POLYJET SIMULATED RUBBER MATERIAL

• The Agilus30 family includes the following basic materials:
  • Agilus30 - a translucent material (Shore A30)
  • Agilus30 Black - a black material (Shore A30)

• Compared to Tango:
  ❑ Better Performance and stronger, 2 times improved tear resistance; 2 ½ times improved tensile strength
  ❑ Improved look and feel
  ❑ Better elongation at break

• Range of DM’s ShoreA 30, 40, 50, 60, 70, 85 & 95
Agilus30 - advanced PolyJet material for rigorous flexible parts.

- Enhanced RP design verification
- Increases RP functional performance

- Easy post-processing using SUP706 soluble support
  - Breakaway and dissolve with WaterJet only

Agilus30 produces easily high-quality, good looking, flexible prototypes in less time
AGILUS30 - Printer Compatibility

COMPATIBLE PRINTERS:
Objet260/350/500™ Connex1/2/3™ Printers

SUP706 SOFTWARE UPGRADE:
• Free of charge for warranty/contract customers
• Additional charge for time and material customers
• Requires on-site visit from a Field Service Engineer
• All new systems come with SUP706 software upgrade*

*Since May 2016, all new Connex systems contain the SUP706 software upgrade.
# AGILUS30 Data Sheet

<table>
<thead>
<tr>
<th>Specification</th>
<th>ASTM</th>
<th>Units</th>
<th>Metric</th>
<th>Units</th>
<th>Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength</td>
<td>D-412</td>
<td>MPa</td>
<td>2.4-3.1 psi</td>
<td>348-450</td>
<td></td>
</tr>
<tr>
<td>Elongation at break</td>
<td>D-412</td>
<td>%</td>
<td>220-270 %</td>
<td>220-270</td>
<td></td>
</tr>
<tr>
<td>Compressive Set</td>
<td>D-395</td>
<td>%</td>
<td>6-7 %</td>
<td>6-7</td>
<td></td>
</tr>
<tr>
<td>Shore Hardness</td>
<td>D-2240</td>
<td>Scale A</td>
<td>30-35 Scale A</td>
<td>30-35</td>
<td></td>
</tr>
<tr>
<td>Tensile Tear Resistance</td>
<td>D-624</td>
<td>Kg/cm</td>
<td>5-7 Lb/in</td>
<td>28-39</td>
<td></td>
</tr>
<tr>
<td>Polymerized density</td>
<td>D-792</td>
<td>g/cm³</td>
<td>1.14-1.15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# AGILUS30 – Technical Spec Highlights

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM</th>
<th>UNITS</th>
<th>Tango Plus</th>
<th>Agilus 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength</td>
<td>D-412</td>
<td>MPa</td>
<td>0.8-1.5</td>
<td>2.4-3.1</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>D-412</td>
<td>%</td>
<td>170-220</td>
<td>220-240</td>
</tr>
<tr>
<td>Shore hardness (A)</td>
<td>D-2240</td>
<td>Scale A</td>
<td>26-28</td>
<td>30-35</td>
</tr>
<tr>
<td>Tensile tear resistance</td>
<td>D-624</td>
<td>Kg/cm</td>
<td>2-4</td>
<td>5-7</td>
</tr>
<tr>
<td>Polymerized density</td>
<td>ASTM D792</td>
<td>g/cm3</td>
<td>1.12-1.13</td>
<td>1.14-1.15</td>
</tr>
<tr>
<td>Water absorption</td>
<td>ASTM 570-98 24hrs</td>
<td>%</td>
<td>3.1-3.3</td>
<td>2.7-3.0</td>
</tr>
</tbody>
</table>
USE CASES FOR AGILUS30

Rapid Prototyping
Rubber-like components, surrounds and overmolding

Consumer Goods
Sporting goods, masks, food storage containers, door seals

Medical Models
Simulating soft tissue for surgical evaluation, planning & training

Tooling
Knobs, jigs, grips, seals, gaskets, hoses, handles
USE CASE: PROTOTYPING SPORTING GOODS AND ACCESSORIES

High tear resistance enables verification and functional prototypes from repeated force breakage

BAND FOR SPORTS WATCH

CHALLENGE
Creating a prototype that simulates end product materials suitable for ergonomic, performance, style and design studies

SOLUTION
Ability to produce a flexible, functional prototype to conduct the needed tests
USE CASE:
TOOLING APPLICATION JIGS FOR MEDICAL DEVICE TESTING
Better performance – Agilus30 holds up to water flow and high pressure

JIGS FOR MEDICAL DEVICE

CHALLENGE
Previous jigs could not withstand water flow and high pressure in order to test the medical device

SOLUTION
Agilus30, with its high tensile strength and improved tear resistance, enabled the medical device to be tested. Additionally, post-processing was easier and more efficient.
AGILUS30 Digital Materials
System availability: Objet 260/350/500 Connex 1/2/3

12 New DMs

8 New DMs
Digital ABS Ivory & Agilus30 Black/Agilus30 DMs
System availability: Objet 260/350/500 Connex 1/2/3

12 new flexible DMs:
6 made of Digital ABS Ivory and Agilus30 Black
6 made of Digital ABS Ivory and Agilus30

New mechanical properties
ShoreA range
AGILUS30 DIGITAL MATERIAL PALETTES

FLEXIBLE MATERIAL PALETTES:
Six palettes
Wide range of Shore A Values (30-95)
FAQs

Q: Can I replace TangoBlackPlus material with Agilus30 Black for same application?
A: Yes, Agilus30 offers even better durability, tear resistance and aesthetic parts.

Q: Do I need to upgrade my printer to print SUP706 with Agilus30 materials?
A: If your printer software is one of the below mentioned then you do not need an update, these versions support both SUP706 and Agilus30. But if you do not have one the below software versions you require a software upgrade and technical on-site visit.
   • Embedded software version 29.2 /38.2/58.2
   • Objet studio version : 9.2.11.6785

Q: Can I continue using Tango materials?
A: Yes. Stratasys currently has no plans to stop sales of Tango family materials.

Q: Does Agilus30 print with SUP706 soluble support completely hands-free?
A: We recommend manually removing large portions of support material first, and then dip it in the alkaline solution bath to speed up the support removal process.
FAQs

Q: Is SUP706 the only support I can use with Agilus30?
A: No, you can also use SUP705.

Q: Does Agilus30 family experience a different water absorption than Tango Plus family?
A: Yes, there is an improvement of 9-13%.

Q: Is there a temperature effect on Agilus30 elasticity?
A: Yes, at room temperature, parts printed with Agilus30 have optimum elasticity. At very low temperatures, parts might become stiff and brittle. Therefore, care and adequate precautions should be taken when packaging parts and models for shipping. Parts regain their original elasticity when warmed above 5 °C (41° F).
FDM NYLON 6™ FOR THE FORTUS 900mc

November 2016
MANUFACTURERS WANT STRONGER 3D PRINTED PROTOTYPES, JIGS & FIXTURES, AND SELECT END-USE PARTS
Stratasys Solution: FDM® Nylon 6 for the Fortus 900MC™

- Combines Strength of ULTEM™ 9085 resin
  - > 67 MPa
- Toughness of Nylon
  - > 38% elongation at break
  - > 106 J/m Impact Resistance (notched)

- Overall, higher strength/stiffness and better appearance compared to Nylon 12
- Specially formulated for FDM printing, delivering the right balance of Nylon 6 properties and ability to successfully print FDM parts

Note:
Compared to pure Nylon 6 in traditional manufacturing, FDM Nylon 6 has slightly lower heat resistance and elongation. It is considered a Nylon 6,10 blend.

ULTEM™ is a registered trademark of SABIC or its affiliates or subsidiaries.
FDM Nylon 6 Targeted Properties

• Most popular class of polyamide materials
• This is a Nylon 6,10 base material
• Strength of ULTEM 9085 and the toughness of Nylon 12
• Excellent general purpose functional prototyping and manufacturing tooling material

<table>
<thead>
<tr>
<th>TARGET PROPERTIES</th>
<th>NYLON 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>9,800 psi</td>
</tr>
<tr>
<td></td>
<td>(67 MPa)</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>323,700 psi</td>
</tr>
<tr>
<td></td>
<td>(2,232 MPa)</td>
</tr>
<tr>
<td>Tensile Elongation</td>
<td>38%</td>
</tr>
<tr>
<td>Impact Resistance (unnotched)</td>
<td>53.8 ft-lbs/inch</td>
</tr>
<tr>
<td></td>
<td>(2873 J/m)</td>
</tr>
<tr>
<td>HDT @ 264 psi</td>
<td>199.4 F(93 C)</td>
</tr>
<tr>
<td>Flame Resistance (UL-94)</td>
<td>HB</td>
</tr>
</tbody>
</table>
Now available on our Stratasys official website:
http://www.stratasys.com/~/media/Main/Files/Material_Spec_Sheets/MSS_FDM_Nylon6_1016a.ashx
FDM Nylon 6 - Safety Data Sheets (SDS)

This important document is available for our customers in various languages on our official website:

http://www.stratasys.com/~media/Main/Files/SDS/Nylon-6/SDS_850171_A_EN_AGHS_Nylon-6.ashx
The Customer
Customer: Automotive Product Development team
Industry: Automotive
Previous prototyping technique: Thermoforming
Part: Engine Cover

The Requirements
• Mounting points that can withstand self-tapping screws
• Chemical resistance to petroleum based products
• Aesthetics for design verification
• Accuracy for fitment check
• Durability for vibration fatigue resistance
FDM Nylon 6 Case Study- (part 2)

The Story
This 3D printed engine cover was used for fit tests on a development vehicle. Leveraging FDM Technologies with FDM Nylon 6 material, the test could easily be completed successfully and efficiently.

Additionally, they were able to validate common under hood maintenance operations before committing to tooling for this design.

The Production part will be made from Injection molding using a Glass filled Nylon 6 material.

T20 0.330 mm (0.013 inch) slice thickness, Solid build style

<table>
<thead>
<tr>
<th>Build Time (HR:MIN)</th>
<th>Model (in³)</th>
<th>Support (in³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>110:31</td>
<td>111</td>
<td>197</td>
</tr>
</tbody>
</table>
FDM NYLON 12CF™
STIFFEST FDM MATERIAL YET
Use Case: Lighter Weight Metal Replacement Prototyping with FDM Nylon 12CF

• Functional performance prototypes – strong and stiff
• Metal replacement parts such as brackets, housings, impellers, etc. that are typically aluminum

Use Case

• SLS is difficult to implement
• CNC machining can be slow and expensive
• Outsourcing can result in long lead times and IP risk

Pain With Current Solutions

• Nylon12CF with 25% greater strength and 100% greater stiffness compared to SLS
• It is FDM – accuracy and weight savings!
• Ideal for end-part functional simulation

SSYS Use Case Solution
Introducing FDM NYLON 12CF (Carbon Fiber) – Properties & Benefits

FDM Carbon fiber-filled thermoplastic material

Nylon 12CF, a carbon fiber-filled thermoplastic delivering the highest strength and stiffness to weight ratio of any Stratasys FDM material

Unique stiffness and strength allows it to:
• Withstand functional testing of prototypes
• Replace metal components in
  • Prototyping
  • Jigs & fixtures
  • Select End-use parts

Highest strength and stiffness to weight ratio
FDM NYLON 12CF - Applications

- Automotive Manufacturing
- Industrial Manufacturing
- Recreational Manufacturing
- Aerospace Manufacturing
FDM NYLON 12CF LIGHTENS THE LOAD IN WEIGHT AND COSTS

Converting metal to plastic

Nylon 12CF is strong enough to replace metal parts, in order to lighten the weight and reduce part costs.

Metal parts produced in Nylon 12CF
- Brake levers
- Caliper cover
- Chain guard
- Engine cover
- Stand
- Foot pegs

Benefits:
- Reduce part costs
- Lighten motorcycle
- Increasing performance
Utah Trikes - Case Study Movie
# FDM NYLON 12CF

Engineering to High Performance Materials (Metric Units)

<table>
<thead>
<tr>
<th>Product Features</th>
<th>Nylon 12</th>
<th>PC</th>
<th>Nylon 6</th>
<th>ULTEM 9085</th>
<th>Nylon 12CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultimate Tensile Strength XY</td>
<td>46 MPa</td>
<td>57 MPa</td>
<td>67 MPa</td>
<td>68 MPa</td>
<td>76 MPa</td>
</tr>
<tr>
<td>Tensile Modulus XY</td>
<td>1,282 MPa</td>
<td>1,944 MPa</td>
<td>2,227 MPa</td>
<td>2,151 MPa</td>
<td>7,529 MPa</td>
</tr>
<tr>
<td>Temperature Resistance (HDT @ 1.82 MPa)</td>
<td>82 C</td>
<td>138 C</td>
<td>93 C</td>
<td>153 C</td>
<td>143 C</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>30%</td>
<td>4.8%</td>
<td>38%</td>
<td>5.8%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>67 MPa</td>
<td>90 MPa</td>
<td>97 MPa</td>
<td>112 MPa</td>
<td>142 MPa</td>
</tr>
<tr>
<td>Izod Impact (unnotched)</td>
<td>1655 J/m</td>
<td>875 J/m</td>
<td>2829 J/m</td>
<td>779 J/m</td>
<td>310 J/m</td>
</tr>
<tr>
<td>Specific Stiffness</td>
<td>1.2 x 10^6 m^2/s^2</td>
<td>1.62 x 10^6 m^2/s^2</td>
<td>-</td>
<td>1.6 x 10^6 m^2/s^2</td>
<td>6.5 x 10^6 m^2/s^2</td>
</tr>
</tbody>
</table>
## FDM NYLON 12CF vs. SLS COMPOSITE MATERIAL

<table>
<thead>
<tr>
<th></th>
<th>FDM Nylon 12CF</th>
<th>SLS Nylon 12CF (NyTek)</th>
<th>Benefits of Nylon 12CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>10,967 psi (75.6 MPa)</td>
<td>8,750 psi (60.3 MPa)</td>
<td><strong>25% improvement in strength</strong></td>
</tr>
<tr>
<td>Modulus</td>
<td>1.1 Msi (7515 MPa)</td>
<td>0.53 Msi (3654 MPa)</td>
<td><strong>100% improvement in stiffness</strong></td>
</tr>
</tbody>
</table>
FDM NYLON 12CF - Requirements

Physical requirements:
- Fortus® 450mc (w/ CF Hardware Upgrade)
- Nylon 12CF Model Material
- SR-110 Support Material
- 0.254 mm (0.01 in) slice thickness

Software requirements
- Insight™ 11.0
- Machine controller software (current)
  Fortus® 450mc 5.5.xxxx

Consumables
- Model tips T20C
- Support tips T12SR-100
- Material canister type- Fortus Plus only (Fortus classic is unavailable)
- Build sheet – Nylon Family build sheets
### FDM NYLON Family - More Specifications

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>NYLON 6</th>
<th>NYLON 12</th>
<th>Nylon 12 CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Black</td>
<td>Black</td>
<td>Black</td>
</tr>
<tr>
<td>Support Material</td>
<td>SR-110</td>
<td>SR-110</td>
<td>SR-110</td>
</tr>
<tr>
<td>Service visit required at install</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>System availability</td>
<td>Fortus 900</td>
<td>Fortus 380, Fortus 450, Fortus 900, Fortus 360, Fortus 400</td>
<td>Fortus 450</td>
</tr>
<tr>
<td>Slice Height Availability</td>
<td>0.010 inch (0.254 mm)</td>
<td>0.007 inch (0.178 mm)</td>
<td>0.010 inch (0.254 mm)</td>
</tr>
<tr>
<td></td>
<td>0.013 inch (0.330 mm)</td>
<td>0.010 inch (0.254 mm)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.013 inch (0.330 mm)</td>
<td></td>
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</tr>
</tbody>
</table>
FDM NYLON 12CF - Build Considerations

- Nylon 12CF Compatible Head Assembly with hardened components
  - Model Tip T20C, Canister Drive Blocks and Fittings

- Special Inside Software Build Mode’s and Styles
  - Toolpath parameter
  - Raster Angle
  - Support Parameter and Support Style
  - Purge Tower

- Machine Preparation and Calibration
- Material Storage and Handling
- Post Processing
FAQs - FDM NYLON 12CF

Q: If I own a Fortus 450mc with a High Performance Upgrade can I run Nylon 12CF?
A: Yes, however the hardware upgrade (PN 316-63500) needs to be purchased to enable operation of the new material.

Q: What support material is used with FDM Nylon 12CF?
A: SR-110, which is the same material as FDM Nylon 12 & FDM Nylon 6.

Q: Can the T20C tip be used with other materials?
A: No, not at this time, the T20C tip is specifically hardened for use with Nylon 12CF material.

Q: Can I use the Carbon Fiber head with other materials?
A: No, it should not be used with any other material other than ASA.

Q: How do I learn the best ways to use Nylon 12CF?
A: An application guide is available explaining the best practices for being successful with this material: http://www.stratasys.com/-/media/Files/Nylon-12CF/MG_FDM_Nylon12CF_0217a_Web.pdf

Q: How much carbon is in Nylon 12CF?
A: Nylon 12CF uses a chopped fiber averaging around 150 microns in length, filled at 35% by weight with the Nylon 12 resin.
FAQs - FDM NYLON 12CF Cont.

Q: How is the surface quality of FDM Nylon12 CF compared to the FDM Nylon 12 we have?
A: It depends on the geometry, it can be very nice in Z, but very rough in XY due to the carbon fibers in the resin. This is a material for functional testing and use, not necessarily for aesthetics.

Q: What is the Z strength of FDM Nylon 12CF?
A: It is 4990 PSI (34.4 MPa), similar to FDM Nylon 12 - 5,600 psi (38.5 MPa). The carbon fibers are aligned in the XY and do not add any strength in the Z direction.

Q: What are the particulars regarding ESD?
A: Nylon 12CF has ESD properties. Its surface and volume resistivity, are better than ABS-ESD7. Surface Resistivity, 3.3x10^6 to 6.9x10^7(ohms); Volume Resistivity 5.4x10^6 to 3.9x10^7(ohms).

Q: Is there print speed differences between Nylon 12CF and Nylon 12?
A: Based on Insight 11.2 estimates, Nylon 12CF builds approximately 10-12% slower than Nylon 12.
Stratasys F123 Series for Designer Workgroups
Smart Prototyping: Most Reliable, Economical and Intelligent 3D Printer Series and Solution For Entire Office

Designed for the way YOU work.

Introducing…

**Stratasys F123™ Series Rapid Prototyping Solution**

Combines powerful FDM technology with design-to-3D print GrabCAD software for most versatile prototyping solution available.

That’s Stratasys intelligence.
The Stratasys F123 Series - More Detail, Variety and Possibilities

4 SLICE HEIGHTS
5, 7, 10 and 13 Slice

4 MATERIALS
PLA, ASA, ABS, PC-ABS

2 Build Speeds

Offering
2 SPOOL SIZES
with many color choices

4 fill styles and
5 support styles
Standard & Engineering-grade Materials
Highest Standards, Most Tested, Aggressively Priced

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<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ABS</strong></td>
<td><strong>PLA</strong></td>
</tr>
<tr>
<td>F170 PLA, ABS, ASA</td>
<td>Most economical</td>
</tr>
<tr>
<td>F270 PLA, ABS, ASA</td>
<td>Balanced properties</td>
</tr>
<tr>
<td>F370 PLA, ABS, ASA, PC-ABS</td>
<td>UV Stability</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ASA</strong></td>
<td><strong>PC-ABS</strong></td>
</tr>
<tr>
<td></td>
<td>Tough and temp resistant</td>
</tr>
</tbody>
</table>
Lower Material Pricing – Across the Board

- Up to 34% price reduction vs Dimension/Fortus 250 ABS pricing
- PLA at half price of the F123’s ABS material price
- High Value Materials: F123’s ASA and PC-ABS material price is lower than Dimension/Fortus 250 ABS pricing
- Large 90CI spool value-priced at 7% less than 60CI spool
- Special Education Pricing: 28% reduction vs. F123 regular pricing (without Soluble Support)
PLA – Fast and Value-Priced Material

QUICKLY CREATE
low-cost parts

Break-away support

Made from
renewable resources

GOOD
tensile strength

COLORS
Natural, Transparent Red, Transparent Yellow, Transparent Green, Transparent Blue, Black, White, Red, Blue, Light Gray, Medium Gray

PERFECT FOR
• Quick concept and verification models
• Inexpensive prototype/part
• User-friendly in office/classroom environments

Best prices available
QSR Soluble Support (Quick Support Release)
Making The Impossible Possible

Create complex parts with internal voids and cavities that are not possible without soluble support
Print full assemblies in a single print
Hands-free post-processing with soluble support

QSR Soluble Support brings new design freedom and capability to produce complex, high-quality 3D printed parts
POLYJET SOLUBLE SUPPORT
Triple Game Changer with SUP706
SUP706 – The Solution

New Soluble Support at a glance

- **Reduces time and labor with hands-free support removal** in the post-process cost per part
- **Freedom to design** intricate & delicate multi-material parts that can be easily leaned
- Improved surface quality of parts.
- Ability to print and clean **fine details & difficult interior cavities**
- **Hands-free support removal**
- **Quicker** support removal (with WaterJet and semi-manual removal)
- Bio-medical approval for use with MED610 and MED620
- Price same as SUP705

SUP706 works with:
- All POLYJET materials ● All Objet 260/350/500 Connex1/2/3 Printers
- Objet 260&500 Dental selection ● All new Objet 260/350/500 Connex 1/2/3 Printers will support SUP706
Support Removal Methods

1. **Dissolve Support Material**
   a. Cleaning Station + Cleaning solution for a duration that is pending geometry
   b. Tap water washing to remove residues of Support and base solution

2. **Break-Away and Dissolve Support Material**
   a. Manual removal most of Support 1-2 minutes per part
   b. Cleaning Station + Cleaning solution for 1-4 hr. (pending geometry)
   c. Tap water washing to remove residues of Support and base solution

3. **Remove Support Material with Water Pressure**
   a. Faster & Easier removal when using WJ (Vs. SUP705)
Case Studies
Case Study 1: Multi color Elements for personalized patient care with SUP706

Objective
Optimize therapy and improve the chances of success with patient-derived surgical pre-planning models.

This is an AVM/hematoma model of a pediatric patient.
- AVMs are a tangle of blood vessels that are abnormal
- AVMs are prone to rupture.
- The clot in the model illustrates tissue saturated by blood

Solution
With SUP706, it is possible to print the delicate Tango DM blood vessels and plan the procedure accurately using Method 1 – Hands free cleaning.
Case Study 2: Fine & Complex Architecture Model with SUP706

‘Rietveld Architecture’ created this single print 1:400 scaled presentation model in 2 prints:
• First print was the building (Multiple DMs in one print)
• Second was the red cores (MY002 DM).
Separating the two made it easier on cleaning the Parts.
Case Study 3: Moving Parts with SUP706

Auto cleaning for moving parts

D-ABS
Case Study 4:
Printed Fine Art Models with SUP706

With SUP706 it was ideal to get such results of this art model
Case Study 5:
Print Intricate Medical Models with SUP706

“The new SU706 support material is a game-changer for making medical models because it drastically reduces the time required to remove support from complex geometries and internal passageways.”
Chad Devine, Operations for 3D Print Labs

<table>
<thead>
<tr>
<th>Manual labor required to remove support material</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous support</td>
<td>8 hours</td>
</tr>
<tr>
<td>SU706</td>
<td>2 hours</td>
</tr>
<tr>
<td>Savings</td>
<td>6 hours 75%</td>
</tr>
</tbody>
</table>

Medical models on display at Houston Methodist DeBakey Heart and Vascular Center
Tips and Tricks
Objective:
How to obtain quality cleaning efficiency and reduce cleaning duration

Method:
First peel support material prior to soak and dissolve

Tip 1: Peeled Vs. Unpeeled

Average reduction in cleaning duration = ~90%!

CLEANING DURATION [HOURS]

ball  lego  braingear  verteile  tube

Before peeling

After peeling
Tip 2: Measuring Cleaning Solution Saturation

Objective: Determine if the alkaline cleaning solution needs to be replaced.

Method:
- Remove all printed models from the cleaning station.
- Make sure that the temperature of the alkaline cleaning solution is 25°C–32°C.
- Agitate the solution for at least five minutes.
- Wait until the solution stops moving & foam disappears.
- Use a hydrometer to determine if the solution needs to be replaced when reaches 15% (Hydrometer is provided with the cleaning station).

<table>
<thead>
<tr>
<th>Saturation (solids%)</th>
<th>Density (g/cm³)</th>
<th>Density (oz/gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean solution (0%)</td>
<td>1.030±0.002</td>
<td>137.53±0.27</td>
</tr>
<tr>
<td>Medium (10%)</td>
<td>1.040±0.002</td>
<td>138.87±0.27</td>
</tr>
<tr>
<td>Maximum (15%)</td>
<td>1.045±0.002</td>
<td>139.54±0.27</td>
</tr>
</tbody>
</table>
Tip 3: Obtain Surface Quality

Objective:
How to obtain best quality surface to avoid a white coating surface

Method:
Wash model immediately after removing from cleaning station in tap water and gently rub surface for best results.

Left side:
Models cleaned in cleaning station and left to dry

Right side:
Models cleaned in cleaning station and washed again in tap water
Tip 4: Glycerol Dip

Objective:
Mechanical properties improvement

Method:
Dip model in Glycerin, 15% ratio
- Recommended Glycerol – technical grade of 97% (purity level).
- It is important not to wash or wipe parts after being dipped in Glycerol.

- Do not use Glycerol dip if you want to postprocess the parts!
  - Paint & Laquere
  - Silicon Molding
  - Metal coating

Note:
Prolonged model soaking in alkaline solution may harm the mechanical properties of the build material.
Tip 5: Grid Styles

Objective:
Learn about more Grid styles printing

Method:
Use **Standard Grid** style on your Objet Studio whenever:
- The model includes floating parts that are more than 30 mm high

Use **heavy Grid** style on your Objet Studio whenever:
- Printing with **Tango materials**.

Note: If you use Standard or Heavy Grid you are required to use Water Jet.
**Tip 6: Deep Cavities**

**Objective:**
How to handle models with deep cavities?

**Method:**
- It is highly recommended to use the Water Jet prior to cleaning station soaking if possible. **Cleaning time will be reduced significantly!**
- It might be helpful to use sacrificial cores, removable after printing. Once remove, deep cavities come in contact with the cleaning solution. **This yields a far shorter cleaning time!**
Tip 7:  
Cleaning Jigs & Channels for Deep Cavities

**Objective:**  
How to handle models with unreachable deep cavities?

**Method:**  
Print custom jigs in order to Direct the cleaning station’s jets to the designated spots. This will significantly shorten the cleaning time.
Tip 8: Immersing Parts in Solution for Long Period of Time

Objective:
How to ensure model dimensional stability

Method:
• Avoid immersing the model in solution for a long period of time. Be aware that this might affect the mechanical properties of the printed part.
• Use a hot air blower which is proved helpful in straightening the thin walls.

Use hot air blower

0.8 mm
Tip 9: Removing SUP706 from Rigur RGD450 & Rigid DM models – special considerations

Objective: How to ensure Rigur models dimensional stability for long duration

Method:
• Clean your Rigur part from support SUP706 using WaterJet only or remove manually.
• Avoid using cleaning station as that might affect the mechanical properties of the printed part.
• Same considerations apply for Rigur & Tango Rigid DM’s when Rigur is the dominant component.

Remove with WaterJet only
Medical Approvals with SUP706
Using SUP706 with Biocompatible Materials

Medical approvals allow using SUP706 with Biocompatible Materials:

- MED 610
- MED 620
Medical Approvals

Stratasys materials, which are denoted biocompatible, have five medical approvals according to the harmonized standard ISO 10993-1: Cytotoxicity, Genotoxicity, Delayed Type Hypersensitivity, Irritation and USP Plastic Class VI.*

Bio-Compatiible materials are suitable for applications requiring prolonged skin contact of over 30 days and short term mucosal-membrane contact of up to 24 hours.

- MED610
- MED620

All tests involve printed parts and not liquid formulations.
The above approvals relate to specific systems and are subject to post processing of parts as described in Stratasys regulatory documents.
Medical Approvals

**Cytotoxicity**
Counts the number of live cells in the presence of extracts of the tested printed material

**Genotoxicity**
Genotoxic substances are capable of causing genetic mutations, which are the cause of many human genetic diseases

**Sensitization**
A measure of change in length of the sample

**Delayed Type Hypersensitivity**
Checks for skin irritation after placing printed material patches along the spinal column

**USP – Class VI – Plastic materials**
- Checks for biological response after Injection of extracts of a printed item
- Checks for tissue reaction after implantation of a printed item

Genotoxicity
Genotoxic substances are capable of causing genetic mutations, which are the cause of many human genetic diseases
PolyJet Soluble Support Material Comparison
<table>
<thead>
<tr>
<th></th>
<th>SUP 706</th>
<th>SUP 705</th>
<th>SUP 707</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printers Coverage</td>
<td>OBJET 260,350,500 Connex 1/2/3</td>
<td>All PJ printers</td>
<td>EDEN260VS</td>
</tr>
<tr>
<td>Bio Approval</td>
<td>Available for Med610 and MED620</td>
<td>Available for FullCure630, 655, MED610, MED620</td>
<td>Not Available</td>
</tr>
<tr>
<td>Support Resin Grid Style</td>
<td>**Lite Grid default</td>
<td>Standard Grid</td>
<td>No Grid</td>
</tr>
<tr>
<td>Model Mechanical Properties</td>
<td>Using WaterJet – same as SUP705 Hands free mode in Matt – required Glycerol solution</td>
<td></td>
<td>Hands free mode in Matt – required Glycerol solution</td>
</tr>
</tbody>
</table>

*Dental availability starting May 17th 2016

**Tango material to be printed with Heavy grid, and floating parts with standard grid which could be only cleaned with WaterJet
FAQs

Q: Are there any changes needed to my printer or software to accept SUP706?
A: Yes, a software update is required by Customer Support on site, to all Connex1,2,3 install base purchased prior to May 17th 2016. Call your local Customer Support to schedule the software update.

Q: Will Stratasys stop selling SUP705?
A: To be determined according to our market requirements.

Q: Can SUP706 be used in the dental series printers?
A: Yes, SUP706 is available for Objet260 Dental Selection, Objet500 Dental Selection,.

Q: Is SUP 706 approved for medical applications?
A: Yes, approved for Bio-medical usage with MED610 and MED620.
THANK YOU

Any questions?

Muchas gracias

Muito obrigado!

stratasys

pixel sistemas