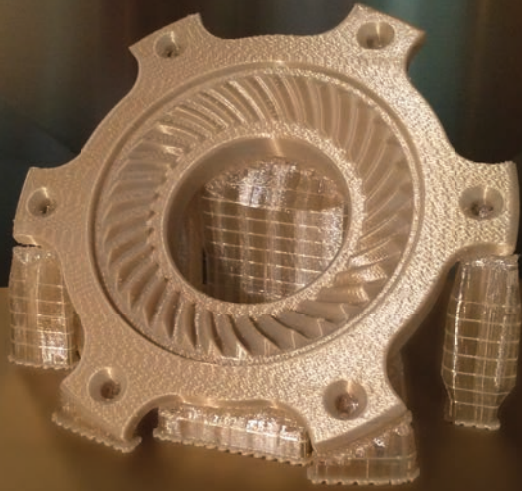




THE AM PRODUCTION FACTORY

TECHNOLOGIES



FDM

Plastic End-Use Parts

FDM Technology produces functional models in the end-use chosen plastic material: the possibility to create **large monolithic models** using materials with exceptional mechanical properties is a great advantage in prototyping terms.

In our factory we employ **three FDM production systems** each with a working chamber of nearly **1m³ of volume** (914mm X 610mm X 914mm / 36"x24"x36") for direct manufacturing of large size monolithic models. We offer a wide range of materials characterized by different mechanical and thermal properties including **fireproof** and **self-extinguishing** materials and materials certified for **extreme production sectors** or the **food industry**.

HIGH-RESISTANCE AND LIGHT-WEIGHT EVEN FOR LARGE MODELS

"ULTEM 9085 has great strength properties over a wide temperature range. We have done testing to show that it is very heat capable of withstanding temperatures from cryogenic all the way up to extreme And it's tough enough to handle the vibration and stress of lift off and flight. We're very satisfied with its performance," explained Greg Arend, ULA's Additive Manufacturing Program Manager of United Launch Alliance. (<https://3dprint.com/59428/united-launch-alliance-rockets/>)

Ultem™ is a family of materials (Ultem 9085 and Ultem 1010) especially developed for extreme sectors such as aerospace, automotive and military applications, it can replace metal parts and components in various fields and without degradation of performance.

With FDM, the material is drawn through a nozzle, where it is heated and is then deposited layer by layer: the modeling possibilities are endless.

END-USE PARTS OF LARGE DIMENSIONS, MODELING FINISHES

Small plastic models can also be made by artisanal 3D printing laboratories, how is **Industrial FDM Additive Manufacturing** different?

- Large monolithic pieces up to 914.4 x 609.6 x 914.4 mm;
- Pattern maker for assembly services and perfect finishing to produce even larger models;
- **Tolerances and surface quality** not reachable by artisanal 3D printers

MATERIALS FOR FDM ADDITIVE MANUFACTURING

Where FDM absolutely shines is in the possibility to use a wide range of materials with different mechanical properties and thermal resistance. The materials available include high-performing options such as **Ultem™ 1010** and **Ultem™ 9085**, while **ASA** offers exceptional UV stability and outstanding aesthetics. The range of materials, detailed on the back of this sheet, offers several combinations and colors.





THE AM PRODUCTION FACTORY

FDM

MATERIALS

Plastic end-use parts

MATERIALS	DESCRIPTION
ASA	With exceptional UV stability and the best aesthetics of any FDM thermoplastic, ASA is poised to become the most popular all-purpose prototyping material. Its UV resistance makes it especially suited in end-use parts for outdoor commercial and infrastructure use.
ABS-M30	ABS-M30 is an ideal material for conceptual modeling, functional prototyping, manufacturing tools, and end-use-parts. ABS-M30 has greater tensile, impact, and flexural strength than standard ABS.
ABS-ESD7	ABS-ESD7 is an ABS thermoplastic with static dissipative properties for applications where a static charge can damage products , impair their performance or cause an explosion.
ABSi	ABSi is an ideal material for conceptual modeling, functional prototyping and direct digital manufacturing. Its translucent nature is beneficial for monitoring material flow and light transmission; it's most commonly used for medical and automotive applications.
PC - Polycarbonate	PC is an industrial thermoplastic, widely used in automotive, aerospace, medical and many other applications. Also, PC has mechanical properties superior to ABS and a number of other thermoplastics.
PC-ISO	PC-ISO (polycarbonate-ISO) is an industrial thermoplastic, which in its raw state, meets the ISO 10993-1 and USP Class VI classification 1 . PC-ISO blends are commonly used in food and drug packaging and medical device manufacturing because of the material's strength and medical compatibility .
PC-ABS	PC-ABS offers the most desirable properties of both materials: the superior strength and heat resistance of PC combined with the flexibility of ABS . PC-ABS blends are commonly used in automotive, electronics and telecommunications applications.
PPSF / PPSU (Polyphenylsulfone)	PPSF / PPSU has the greatest heat and chemical resistance; it's ideal for aerospace, automotive and medical applications. PPSF parts have great dimensional accuracy and can be sterilized via steam autoclave, EtO sterilization, plasma sterilization, chemical sterilization and radiation.
Nylon 12	Nylon 12 is ideal for applications requiring repetitive snap fits , high fatigue resistance, strong chemical resistance and press-fit inserts. Nylon 12 is primarily used in aerospace, automotive and consumer goods industries to take on everything from tooling, jigs and fixtures to covers, panels and vibration resistant components.
Nylon 12CF™	Nylon 12CF™ is a carbon-filled thermoplastic material with excellent structural characteristics. The material is comprised of a blend of Nylon 12 resin and chopped carbon fiber, at a loading of 35% by weight . This combination produces one of the strongest thermoplastics in the FDM® material portfolio.
Nylon 6™	Nylon 6™ combines strength and toughness superior to other FDM Thermoplastics, for applications that require strong, customized parts and tooling that lasts longer and withstands rigorous functional testing .
ULTEM™ 1010	ULTEM™ 1010 is a high-performance FDM resin that offers excellent strength, thermal stability . With food-contact and biocompatibility certifications , ULTEM® 1010 resin is perfect for food-production tools and custom medical devices.
ULTEM™ 9085	ULTEM™ 9085 is a flame retardant high performance thermoplastic material. It is ideal for the transportation industry due to its high strength-to-weight ratio and its FST (flame, smoke, and toxicity) certification . These unique characteristics make it an excellent choice for aerospace and ground vehicles, and vessels.
Antero 800NA	Antero 800NA PEKK-based thermoplastic combines FDM's design freedom and ease of use with the excellent mechanical properties and low outgassing characteristics of PEKK material.

ASA

With **exceptional UV stability** and the **best aesthetics** of any FDM thermoplastic, ASA is poised to become the most popular all-purpose prototyping material. Its UV resistance makes it especially suited in end-use parts for **outdoor commercial and infrastructure use**. And its **matte finish** makes it ideal for attractive prototypes in consumer **sporting goods, tools and automotive components and accessories**.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength, Yield (Type 1, 0.125", 0.2"/min)	ASTM D638	4,200 psi	29 MPa
Tensile Strength, Ultimate (Type 1, 0.125", 0.2"/min)	ASTM D638	4,750 psi	33 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	290,000 psi	2,010 MPa
Elongation at Break (Type 1, 0.125", 0.2"/min)	ASTM D638	9 %	9 %
Elongation at Yield (Type 1, 0.125", 0.2"/min)	ASTM D638	2 %	2 %
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	8,700 psi	60 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	270,000 psi	1,870 MPa
Flexural Strain at Break (Method 1, 0.05"/min)	ASTM D790	No Break	No Break
IZOD Impact, notched XZ (Method A, 23°C)	ASTM D256	1.2 ft-lb/in	64 J/m
IZOD Impact, un-notched XZ (Method A, 23°C)	ASTM D256	6 ft-lb/in	321 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi	ASTM D648	208°F	98°C
Heat Deflection (HDT) @ 264 psi	ASTM D648	196°F	91°C
Vicat Softening Temp. (Rate B/50)	ASTM D1525	217°F	103°C
Glass Transition (Tg)	DSC (SSYS)	226°F	108°C

Electrical Properties

	Test Method	Orientation	Value Range
Volume Resistivity	ASTM D257	XZ	1.0E14- 1.0E15 ohm-cm
Dielectric Constant	ASTM D150-98	XZ	2.97 - 3.04
Dissipation Factor	ASTM D150-98	XZ	0.009
Dielectric Strength (Method A)	ASTM D149-09	XZ	329 V/mil

Other

	Test Method	Value	Available Colors										
Specific Gravity	ASTM D792	1.08	<table border="0"> <tr> <td> Ivory</td> <td> Black</td> </tr> <tr> <td> Light Gray</td> <td> Dark Gray</td> </tr> <tr> <td> White</td> <td> Dark Blue</td> </tr> <tr> <td> Green</td> <td> Yellow</td> </tr> <tr> <td> Orange</td> <td> Red</td> </tr> </table>	 Ivory	 Black	 Light Gray	 Dark Gray	 White	 Dark Blue	 Green	 Yellow	 Orange	 Red
 Ivory	 Black												
 Light Gray	 Dark Gray												
 White	 Dark Blue												
 Green	 Yellow												
 Orange	 Red												

ABS M30

ABS-M30 is up to **25-70 percent stronger than standard ABS** and is an ideal material for conceptual modeling, functional prototyping, manufacturing tools, and end-use-parts.

ABS-M30 has greater tensile, impact, and flexural strength than standard ABS. Layer bonding is significantly stronger than that of standard ABS, for a more durable part.

This results in more realistic functional tests and higher quality parts for end use.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 0.125", 0.2"/min)	ASTM D638	5,200 psi	36 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	350,000 psi	2,413 MPa
Tensile Elongation (Type 1, 0.125", 0.2"/min)	ASTM D638	4 %	4 %
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	8,800 psi	61 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	336,000 psi	2,317 MPa
IZOD Impact, notched (Method A, 23°C)	ASTM D256	2.6 ft-lb/in	139 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	5.3 ft-lb/in	283 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi, 0.125" unannealed	ASTM D648	204°F	96°C
Heat Deflection (HDT) @ 264 psi, 0.125" unannealed	ASTM D648	180°F	82°C
Vicat Softening Temp. (Rate B/50)	ASTM D1525	210°F	99°C
Coefficient of Thermal Expansion (fl ow)	ASTM E831	4.9E-05 in/in/°F	8.82E-05 mm/mm/°C
Coefficient of Thermal Expansion (xfl ow)	ASTM E831	4.7E-05 in/in/°F	8.46E-05 mm/mm/°C
Glass Transition (Tg)	DSC (SSYS)	226°F	108°C
Melt Point	-----	Not Applicable	Not Applicable

Other

	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.04	<input type="checkbox"/> Ivory <input type="checkbox"/> Dark Gray <input type="checkbox"/> White <input type="checkbox"/> Red <input type="checkbox"/> Black <input type="checkbox"/> Blue
Dielectric Strength	IEC 60112	28.0 kV/mm	

ABS-ESD7

ABS-ESD7 (acrylonitrile butadiene styrene-electrostatic dissipative) is an **ABS thermoplastic** with static dissipative properties for applications where a **static charge can damage products, impair their performance or cause an explosion**.

ABS-ESD7 prevents a buildup of static electricity, so it will not produce a static shock or cause other materials like powders, dust and fine particles to stick to it. **Ideal for electronic products with circuit boards** and for the **transportation and industrial equipment industries**.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 0.125", 0.2"/min)	ASTM D638	5,200 psi	36 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	350,000 psi	2,400 MPa
Tensile Elongation (Type 1, 0.125", 0.2"/min)	ASTM D638	3%	3%
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	8,800 psi	61 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	350,000 psi	2,400 MPa
IZOD Impact, notched (Method A, 23°C)	ASTM D256	2.1 ft-lb/in	111 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	1.1 ft-lb/in	55 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi, 0.125" unannealed	ASTM D648	204°F	96°C
Heat Deflection (HDT) @ 264 psi, 0.125" unannealed	ASTM D648	180°F	82°C
Vicat Softening Temperature (Rate B/50)	ASTM D1525	210°F	99°C
Coefficient of Thermal Expansion (flow)	ASTM E831	4.95 in/in/°F	8.825 mm/mm/°C
Coefficient of Thermal Expansion (xflow)	ASTM E831	4.75 in/in/°F	8.465 mm/mm/°C
Glass Transition Temp. (Tg)	DSC (SSYS)	226°F	108°C
Melt Point	-----	Not Applicable	Not Applicable

Other

	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.04	■ Black
Volume Resistivity	ASTM D257	4.0x10 ¹⁰ - 3.0x10 ⁹ ohms	
Surface Resistance	ASTM D257	10 ⁹ - 10 ⁶ ohms	

ABSi

ABSi is an ideal material for **conceptual modeling**, **functional prototyping** and **direct digital manufacturing**. Its strength is superior to standard ABS, and the translucent nature of ABSi is beneficial for **monitoring material flow** and **light transmission**, most commonly used for **medical** and **automotive applications**.

ABSi made parts are visually unique, dimensionally accurate, durable and hold their shape over time.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 2"/min)	ASTM D638	5,400 psi	37 MPa
Tensile Modulus	ASTM D638	277,700 psi	1,915 MPa
Tensile Elongation	ASTM D638	4.4 %	4.4 %
Flexural Stress (Method 1, 0.05"/min)	ASTM D790	8,980 psi	62 MPa
Flexural Modulus	ASTM D790	278,000 psi	1,917 MPa
Flexural Elongation	ASTM D790	< 80 %	< 80 %
IZOD Impact, notched (Method A, 23°C)	ASTM D256	1.8 ft-lb/in	96.4 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	3.6 ft-lb/in	191.1 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi, 0.125" unannealed	ASTM D648	188°F	86°C
Heat Deflection (HDT) @ 264 psi, 0.125" unannealed	ASTM D648	163°F	73°C
Coefficient of Thermal Expansion	ASTM D696	6.7E-06 in/in/°F	12.1E-05 mm/mm/°C
Glass Transition Temp. (Tg)	DSC (SSYS)	240°F	116°C
Melt Point	-----	Not Applicable	Not Applicable

Other

	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.08	<input type="checkbox"/> Translucent Natural <input type="checkbox"/> Translucent Amber <input type="checkbox"/> Translucent Red

PC (Polycarbonate)

A true industrial thermoplastic, **PC (polycarbonate)** is widely used in **automotive, aerospace, medical** and many other applications. PC offers accuracy, durability and stability, creating strong parts that withstand functional testing. A PC part is 5-60 percent stronger than a part made on other FDM systems.

It also has **superior mechanical properties** to ABS and a number of other thermoplastics. PC can be used for conceptual modeling, functional prototyping, manufacturing tools, and end-use-parts.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 0.125", 0.2"/min)	ASTM D638	9,800 psi	68 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	330,000 psi	2,280 MPa
Tensile Elongation (Type 1, 0.125", 0.2"/min)	ASTM D638	4.8%	4.8%
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	15,100 psi	104 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	324,000 psi	2,234 MPa
IZOD Impact, notched (Method A, 23°C)	ASTM D256	1 ft-lb/in	53 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	6 ft-lb/in	320 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi	ASTM D648	280°F	138°C
Heat Deflection (HDT) @ 264 psi	ASTM D648	261°F	127°C
Vicat Softening	ASTM D1525	282°F	139°C
Glass Transition (Tg)	DMA (SSYS)	322°F	161°C
Melt Point	-----	Not Applicable	Not Applicable

Other

	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.2	<input type="checkbox"/> White
Coefficient of Thermal Expansion	ASTM E831	3.8E -05 in/in/F°	
Dielectric Strength	IEC 60112	15.0 kV/mm	
Dielectric Constant @ 60 Hz	IEC 60250	3.17	
Dielectric Constant @ 1 Mhz	IEC 60250	2.96	

PC-ISO

PC-ISO (polycarbonate-ISO), an industrial thermoplastic, which in its raw state, **meets the ISO 10993-1 and USP Class VI classification 1**. PC-ISO blends are commonly used in **food and drug packaging** and **medical device manufacturing** because of the material's strength and medical compatibility. Available in **various colors**.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 0.125", 0.2"/min)	ASTM D638	8,265 psi	57 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	289,768 psi	998 MPa
Tensile Elongation (Type 1, 0.125", 0.2"/min)	ASTM D638	4.3%	4.3%
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	13,089 psi	90 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	310,439 psi	2,140 MPa
IZOD Impact, notched (Method A, 23°C)	ASTM D256	1.6 ft-lb/in	86 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	1 ft-lb/in	53 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi	ASTM D648	271°F	133°C
Heat Deflection (HDT) @ 264 psi	ASTM D648	260°F	127°C
Vicat Softening	ISO 306	282°F	139°C
Glass Transition Temp. (Tg)	DMA (SSYS)	322°F	161°C
Melt Point	-----	Not Applicable	Not Applicable

Other

	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.2	<input type="checkbox"/> White <input type="checkbox"/> Translucent Natural
Dielectric Constant @ 60 Hz	IEC 60250	3.17	
Dielectric Constant @ 1 MHz	IEC 60250	2.96	

PC-ABS

PC-ABS (polycarbonate-ABS) is one of the most widely used industrial thermoplastics. PC-ABS offers the **most desirable properties of both materials - the superior strength and heat resistance of PC and the flexibility of ABS**. PC-ABS blends are commonly used in **automotive, electronics and telecommunications applications**.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 0.125", 0.2"/min)	ASTM D638	5,900 psi	41 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	278,000 psi	1,917 MPa
Tensile Elongation (Type 1, 0.125", 0.2"/min)	ASTM D638	6%	6%
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	9,800 psi	68 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	280,000 psi	1,931 MPa
IZOD Impact, notched (Method A, 23°C)	ASTM D256	3.7 ft-lb/in	196 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	9 ft-lb/in	481 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi	ASTM D648	230°F	110°C
Heat Deflection (HDT) @ 264 psi	ASTM D648	205°F	96°C
Vicat Softening	ASTM D1525	234°F	112°C
Coefficient of Thermal Expansion	-----	4.10 E-05 in/in/°F	-----
Glass Transition Temp. (Tg)	DMA (SSYS)	257°F	125°C
Melt Point	-----	Not Applicable	Not Applicable

Other

	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.20	<div style="display: flex; align-items: center;"> <div style="width: 15px; height: 15px; background-color: black; margin-right: 5px;"></div> Black </div>
Density	ASTM D792	0.0397 lb/in3	
Dielectric Strength	IEC 60112	35.0 kV/mm	
Dielectric Constant @ 100 Hz	IEC 60250	3.1	
Dielectric Constant @ 100 Mhz	IEC 60250	3.0	

PPSF (Polyphenylsulfone)

PPSF/PPSU material has the greatest **heat and chemical resistance** of all Fortus materials - ideal for **aerospace, automotive and medical applications**. PPSF parts are not only mechanically superior, but also **dimensionally accurate**, to better predict end-product performance. Users can also **sterilize PPSF** via steam autoclave, EtO sterilization, plasma sterilization, chemical sterilization and radiation.


Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 0.125", 0.2"/min)	ASTM D638	8,000 psi	55 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	300,000 psi	2,068 MPa
Tensile Elongation (Type 1, 0.125", 0.2"/min)	ASTM D638	3%	3%
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	15,900 psi	110 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	320,000 psi	2,206 MPa
IZOD Impact, notched (Method A, 23°C)	ASTM D256	1.1 ft-lb/in	58.73 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	3.1 ft-lb/in	165.5 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 264 psi	ASTM D648	372°F	189°C
Coefficient of Thermal Expansion	ASTM D696	3.1 E-05 in/in/°F	5.5 E-05 mm/mm/°C
Glass Transition Temp. (Tg)	DMA (SSYS)	446°F	230°C
Melt Point	-----	Not Applicable	Not Applicable

Other

	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.28	 Tan
Flame Classification	UL94	V0 (0.126", 3.2 mm)	
Rockwell Hardness	ASTM D785	M86	
Dielectric Strength	IEC 60112	14.6 kV/mm	
Dielectric Constant @ 60 Hz	IEC 60250	3.45	

Environmental Resistance

	24 hours @23°C (73°F)	24 hours @100°C (212°F)
Antifreeze (Prestone), 50%	Passed	Passed
Gasoline-Unleaded	Passed	Not tested
Motor Oil 10W-40	Passed	Passed
Power Steering Fluid	Passed	Passed
Transmission Fluid	Passed	Passed
Windshield Washer Fluid, 50%	Passed	Not tested

NYLON 12

Nylon 12 is the first material of nylon offerings, complementing the current portfolio of FDM materials and enabling new applications requiring: **repetitive snap fits, high fatigue resistance, strong chemical resistance and press (friction) fit inserts.** Nylon 12 is primarily used in **aerospace, automotive and consumer goods industries** to take on everything from tooling, jigs and fixtures to covers, panels and vibration resistant components.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 0.125", 0.2"/min)	ASTM D638	7,700 psi	53 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	190 kpsi	1,310 MPa
Elongation at Break (Type 1, 0.125", 0.2"/min)	ASTM D638	9.5%	9.5%
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	10,200 psi	70 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	190 kpsi	1,310 MPa
Flexural Strain at Break	ASTM D790	No Break	No Break
IZOD Impact, notched (Method A, 23°C)	ASTM D256	2.8 ft-lb/in	150 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	>37.4 ft-lb/in	>2,000 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi annealed	ASTM D648	206.6°F	97°C
Heat Deflection (HDT) @ 66 psi unannealed	ASTM D649	167°F	75°C
Heat Deflection (HDT) @ 264 psi annealed	ASTM D650	179.6°F	82°C
Heat Deflection (HDT) @ 264 psi unannealed	ASTM D651	131°F	55°C
Melt Point	-----	352.4°F	178°C

Available Colors

■ Black

Nylon12 CF

FDM Nylon 12CF™ is a carbon-filled thermoplastic with excellent structural characteristics. The material is comprised of a blend of Nylon 12 resin and chopped carbon fiber, at a loading of 35% by weight. This combination produces **one of the strongest thermoplastics in the FDM® material portfolio**. It has the highest flexural strength of any FDM thermoplastic, resulting in the highest stiffness-to-weight ratio.

Appropriate uses include **strong but lightweight tooling applications** and **functional prototypes** in the **aerospace, automotive, industrial and recreational manufacturing industries**.

Mechanical Properties

	Test Method	XZ AXIS	ZX AXIS
Tensile Strength, Yield (Type 1, 0.125", 0.2"/min) PSI	ASTM D638	63 MPa	29 MPa
Tensile Strength, Ultimate (Type 1, 0.125", 0.2"/min) PSI	ASTM D638	76 MPa	34MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min) PSI	ASTM D638	7.6 GPa	2.3 GPa
Tensile Elongation at Break (Type 1, 0.125", 0.2"/min)	ASTM D638	1.9%	1.2%
Flexural Strength (Method 1, 0.05"/min) PSI	ASTM D790	142 MPa	58 MPa
Flexural Modulus (Method 1, 0.05"/min) PSI	ASTM D790	10.3 GPa	2.07 GPa
Flexural Strain at Break (Method 1, 0.05"/min) PSI	ASTM D790	3%	3%
IZOD Impact, notched (Method A, 23 °C) ft-lbf/in	ASTM D256	85 J/m	21 J/m
IZOD Impact, un-notched (Method A, 23 °C) ft-lbf/in	ASTM D256	307 J/m	85 J/m

Electrical Properties

	Test Method	VALUE
Volume Resistivity	ASTM D257	1.4*105 - 1.01*106 Ω-cm
Surface Resistivity	ASTM D257	3.3*104 - 6.9*105 Ω/sq

Thermal Properties

	Test Method	VALUE
Heat Deflection (HDT) @ 264 psi	ASTM D648	143 °C
Glass Transition Temperature (Tg)	ASTM D7426-08	41 °C
Melting Temperature	-----	223 °C

Other

	Test Method	VALUE
Specific Gravity	ASTM D792	1.15

Nylon 6

FDM Nylon 6™ combines **strength and toughness** superior to other FDM Thermoplastics, for applications that require strong, customized parts and tooling that lasts longer and withstands rigorous functional testing.

Engineered with nylon 6, a popular thermoplastic for manufacturing, this material works with the **Fortus 900mc™** to produce durable parts with a clean finish and high break resistance. FDM Nylon 6 is ideal for product manufacturers and development engineers in **automotive, aerospace, consumer goods and industrial manufacturing**.

Mechanical Properties


	Test Method	XZ AXIS	ZX AXIS
Tensile Strength, Yield (Type 1, 0.125", 0.2"/min)	ASTM D638	49.3 MPa	28.9 MPa
Tensile Strength, Ultimate (Type 1, 0.125", 0.2"/min)	ASTM D638	67.6 MPa	36.5 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	2,232 MPa	1,817MPa
Elongation at Break (Type 1, 0.125", 0.2"/min)	ASTM D638	38%	3.2%
Elongation at Break (Type 1, 0.125", 0.2"/min)	ASTM D638	2.3%	1.7%
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	97.2 MPa	82 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	2,196 MPa	1,879 MPa
Flexural Strain at Break	ASTM D790	No Break	No Break
IZOD impact - notched (Method A, 23°C)	ASTM D256	106 J/m	43 J/m
IZOD impact - unnotched (Method A, 23°C)	ASTM D256	2,873 J/m	192 J/m

Thermal Properties

	VALUE
Heat Deflection (HDT) @ 264 psi	93 °C

ULTEM® 1010

ULTEM® 1010 resin is a high-performance FDM and it offers excellent strength, thermal stability and the ability to withstand steam autoclaving. With food-contact and bio-compatibility certifications, ULTEM® 1010 resin is perfect for food-production tools and custom medical devices. ULTEM® 1010 resin offers high heat and chemical resistance, tensile strength and it's ideal for out-of-cabin aerospace applications and automotive applications.

Mechanical Properties			
	Test Method	English	Metric
Tensile Strength, Yield (Type 1, 0.125", 0.2"/min)	ASTM D638	11,735 psi	81 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	402,000 psi	2,772 MPa
Elongation at Break (Type 1, 0.125", 0.2"/min)	ASTM D638	3.3 %	3.3 %
Elongation at Yield (Type 1, 0.125", 0.2"/min)	ASTM D638	2.2 %	2.2 %
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	20,835 psi	144 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	409,000 psi	2,820 MPa
Flexural Strain at Break (Method 1, 0.05"/min)	ASTM D790	No Break	No Break
IZOD Impact, notched (Method A, 23 °C)	ASTM D256	0.8 ft-lb/in	41 J/m
IZOD Impact, un-notched (Method A, 23 °C)	ASTM D256	6.1 ft-lb/in	327 J/m
Thermal Properties			
	Test Method	English	Metric
Heat Deflection (HDT) @ 66 psi, 0.125"	ASTM D648	421°F	216°C
Heat Deflection (HDT) @ 264 psi, 0.125"	ASTM D648	415°F	213°C
Vicat Softening Temp. (Rate B/50)	ASTM D1525	416°F	214°C
Coefficient of Thermal Expansion	ASTM E831	26 uin/(in·°F)	47 µm/(m·°C)
Coefficient of Thermal Expansion (xflow)	ASTM E831	23 uin/(in·°F)	41 µm/(m·°C)
Glass Transition Temperature (Tg)	DSC (SSYS)	419°F	215°C
Melt Point	-----	Not Applicable	Not Applicable
Electrical Properties			
	Test Method	Orientation	Value Range
Volume Resistivity	ASTM D257	XZ	1.0x10 ¹⁴ - 8.96x10 ¹⁵ ohm-cm
Dielectric Constant	ASTM D150-98	XZ	2.67
Dissipation Factor	ASTM D150-98	XZ	0.001
Dielectric Strength (Method A)	ASTM D149-09	XZ	240 V/mil
Other			
	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.27	 Tan
Flame Classification	UL94	V0 (1.5 mm), 5VA (3 mm)	
Rockwell Hardness	ASTM D785	109	
UL File Number	-----	E345258	
Food Safety Certification	NSF 51	Certified	
Bio-compatibility Certification	ISO 10993/USP Class VI	Certified	

ULTEM® 9085

ULTEM®9085 is a **flame retardant** high performance thermoplastic for **direct digital manufacturing** and **rapid prototyping**. It is ideal for the transportation industry due to its **high strength-to-weight ratio** and its FST (flame, smoke, and toxicity) rating. This unique material's preexisting certifications make it an excellent choice for the **commercial transportation industry** – especially **aerospace, marine** and **ground vehicles**.

ULTEM®9085 allows design and manufacturing engineers to produce fully functional parts that are ideal for advanced functional prototypes or end use without the cost or lead time of traditional tooling.

Mechanical Properties

	Test Method	English	Metric
Tensile Strength (Type 1, 0.125", 0.2"/min)	ASTM D638	10,390 psi	71.64 MPa
Tensile Modulus (Type 1, 0.125", 0.2"/min)	ASTM D638	322 kpsi	2,220 MPa
Tensile Elongation (Type 1, 0.125", 0.2"/min)	ASTM D638	5.9%	5.9%
Flexural Strength (Method 1, 0.05"/min)	ASTM D790	16,700 psi	115.1 MPa
Flexural Modulus (Method 1, 0.05"/min)	ASTM D790	362.6 kpsi	2,507 MPa
IZOD Impact, notched (Method A, 23°C)	ASTM D256	2.0 ft-lb/in	106 J/m
IZOD Impact, un-notched (Method A, 23°C)	ASTM D256	11.5 ft-lb/in	613.8 J/m

Thermal Properties

	Test Method	English	Metric
Heat Deflection (HDT) @ 264 psi, 0.125" unannealed	ASTM D648	307°F	153°C
Coefficient of Thermal Expansion	ASTM E831	3.67x10 ⁻⁵ in/(in·°F)	65.27 µm/(m·°C)
Glass Transition Temperature (Tg)	DSC (SSYS)	367°F	186°C
Melt Point	-----	Not Applicable	Not Applicable


Other

	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.34	■ Tan
Flame Characteristics	Test Method	Value	■ Black
Oxygen Index	ASTM D2863	0.49	
Vertical Burn (Test a (60s), passes at)	FAR 25.853	2 seconds	
FAA Flammability (Method A/B)	FAR 25.853	< 5	
OSU Peak Heat Release (5 minute test)	FAR 25.853	36 kW/m ²	
OSU Total Heat Release (2 minute test)	FAR 25.853	16 kW·min/m ²	

Antero 800NA

Antero 800NA is a PEEK-based FDM thermoplastic. It combines FDM's design freedom and ease of use with excellent strength, toughness and wear-resistant properties of PEEK material. Antero 800NA exhibits **high resistance, chemical resistance, low outgassing** and **dimensional stability**, particularly in large parts.

Appropriate applications include **aircraft components exposed to jet fuel, oil and hydraulic fluid, spacecraft parts that demand low outgassing** and **chemical-resistant industrial parts**. Using Antero 800NA with FDM technology avoids the waste associated with subtractive manufacturing of high-cost bulk PEEK material.

Mechanical Properties			
	Test Method	XZ AXIS	ZX AXIS
Tensile Strength, Ultimate (Type 1, 0.125 in., 0.2 in./min)	ASTM D638	93.1 ± 0.4 MPa	45.9 ± 5.3 MPa
Tensile Modulus (Type 1, 0.125 in., 0.2 in./min)	ASTM D638	3.1 ± 0.3 GPa	3.5 ± 0.7 GPa
Elongation at Break (Type 1, 0.125 in., 0.2 in./min)	ASTM D638	6.40 ± 1.05%	1.22 ± 0.28%
Flexural Strength (Method 1, 0.05 in./min)	ASTM D790	142 ± 3 MPa	64 ± 10 MPa
Flexural Modulus (Method 1, 0.05 in./min)	ASTM D790	3.1 ± 0.1 GPa	2.7 ± 0.1 GPa
Flexural Strain at Break (Method 1, 0.05 in./min)	ASTM D790	No break	2.41 ± 0.39%
Notched Impact (Method A, 23 °C)	ASTM D256	37 ± 6 J/m	27 ± 5 J/m
Compressive Strength, Ultimate (Method 1, 0.05 in./min)	ASTM D695	100 ± 2 MPa	101 ± 3 MPa
Compressive Modulus (Method 1, 0.05 in./min)	ASTM D695	2.45 ± 0.01 GPa	2.3 ± 0.1 GPa
Thermal Properties			
	Test Method	VALUE	
Heat Deflection (HDT) @ 66 psi	ASTM D648	150 °C	
Heat Deflection (HDT) @ 264 psi	ASTM D648	147 °C	
Glass Transition Temperature (Tg)	ASTM D7426-08	149 °C	
Electrical Properties			
	Test Method	XY (Value Range)	ZX (Value Range)
Volume Resistivity	ASTM D257	> 1.4 x 10 ¹⁴ Ω	> 1.4 x 10 ¹⁴ Ω
Dielectric Constant	ASTM D150-98	3.23	3.32
Dissipation Factor	ASTM D150-98	0.004	0.003
Other			
	Test Method	Value	Available Colors
Specific Gravity	ASTM D792	1.28	 Natural
Chemical Compatibility	MIL-STD-810G (Method 504.1)	No visible damage	



THE AM PRODUCTION FACTORY

GUIDE Material Selection

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	MATERIAL	DESCRIPTION	PROTOTYPES			Color
			Functional	Aesthetic	Stiffness	
DMLS / SLM	Scalmalloy®	This material is corrosion-resistant and combines the low weight of aluminium with almost the specific strength of titanium.				
	Aluminium HTA	Aluminium HTA - High Temperature Aluminium – is a material developed with the objective of ensuring high performance even at 190—200°C.				
	Alloy 263	Alloy 263 is a nickel-cobalt-chromium-molybdenum alloy designed specifically to combine very good strength properties with excellent fabrication characteristics in the annealed condition. The alloy is also age hardenable.				
	Aluminium AlSi7Mg 0.6 (A357)	Definitive aluminum, very workable and extremely resistant. Very low specific weight (light). AlSi7Mg is an alloy for aerospace applications.				
	Aluminium AlSi10Mg					
	Titanio Ti6Al4V (Grade 23 ELI)	Titanium grade 23, ideal for use in automotive, medical and jewelry applications according to ASTM F136-02a.				
	Inconel 718	Nickel based alloy for the production of components for high temperatures applications.				
	Inconel 625					
	Stainless Steel AISI 316L	It's an austenitic stainless steel for the production of functional parts or components for pre-production moulds.				
	Stainless Steel 17-4ph	It's a precipitation hardening stainless steel for the production of functional parts or medical instruments.				
	Stainless Steel 15-5PH	15-5 PH Stainless Steel is a martensitic precipitation-hardening stainless steel that provides an outstanding combination of high strength, good corrosion resistance, good mechanical properties at temperatures up to 600 °F (316 °C).				
	Cobalt-Chrome F75	Material with high mechanical and thermal resistance, ideal for models with thin walls and subjected to high temperatures.				
	Remanium® Star CL	Cobalt Chrome for dental applications.				
	Bronze	It's a material whose melting properties make it outstandingly suited to generative processing.				
	Copper Alloy CuNi2SiCr	Material with favorable combination of electrical and thermal conductivity accompanied by high stiffness.				
	Maraging Steel 1.2709	Material for the production of components for tool inserts with conformal cooling and production of functional components.				
	NickelAlloy HX	NickelAlloy HX is a nickel-chromium-iron-molybdenum alloy in fine powder form. This type of alloy is characterized by having high strength and oxidation resistance also at elevated temperatures and is often used up to 1200°. Therefore, its applications can be found in aerospace technology, Oil & Gas and gas turbine parts.				
	Alloy 282	Alloy 282 is a superalloy suitable for the aerospace and Oil & Gas industries developed for use in critical applications at temperatures close to 1000 °C as turbine parts and exhausts.				
AISI 420	The AISI 420 is a self-hardening martensitic steel which has complementary characteristics to ferritic and austenitic steels. The hardening process to which it is subjected makes it very useful for cutlery, structural parts, surgical and dental instruments, parts of valves.					
Tungsten	Tungsten is a material with high wear resistance used for the production of tools for the metalworking, mining, petroleum and construction industries. Tungsten is radiation-resistant and is widely used for aerospace applications.					
SLS	PA 603-CF	PA 603-CF is a carbon fiber filled nylon 12 easy to process, strong, light weight filled material. Its peculiarities are: low specific weight, good dimensional stability, excellent mechanical properties and excellent resistance to warping.	✓	✓	Rigid	Black
	PA 620-MF	PA 620-MF is a mineral fiber filled nylon 12 easy to process, performing and heavier weight filled material. Fibers have been optimized to produce a smooth surface finish without sacrificing feature detail for mechanical properties.	✓	✓	Rigid	White, Black
	PA 6	The PA6 material is a polyamide widely used in all those applications where the components are subject to wear or friction. Compared to PA12, it has superior mechanical properties.	✓		Semi-Rigid	White
	WhiteSinter	Standard white nylon (PA12) with good characteristics of flexibility and elasticity.		✓	Semi-Rigid	White
	DuraForm EX Black	DuraForm EX is an impact resistant rigid plastic that is ideal for applications where impact resistance is required and functional hinges. DuraForm EX combines the characteristics of ABS with extraordinary flexural strength and it is perfect for creating functional snaps and hinges.	✓	✓	Rigid	Black
	Polypropylene (PP)	Polypropylene (PP) for Selective Laser Sintering. With this material pre-series parts can thus be produced in the same basic material as large series parts. Decisive advantages of this material are the outstanding toughness and media resistance.	✓	✓	Semi-Rigid	White
	TPU	Thermoplastic elastomer material with rubber-like flexibility and functionality for use with sPro 60 HD-HS.	✓	✓	Elastic	Ivory, Yellow, Black, Red, Blue
	Castform™ PS	Castform™ PS is a Styrene-based, expendable pattern casting material, compatible with most standard foundry processes. For prototype metal castings and low to medium production runs without tooling.	✓			Red
	FlexSinter	Very tough elastomer, available in various colors; aesthetic quality lower than that of polyjet rubber.	✓		Elastic	Ivory, Yellow, Black, Red, Blue
	Allusinter	Nylon reinforced with aluminum. Structural material, rigid and with high mechanical strength. Excellent reproduction of details.	✓	✓	Rigid	Light Gray

	MATERIAL	DESCRIPTION	PROTOTYPES		Stiffness	Color
			Functional	Aesthetic		
FDM	ASA	It's similar to ABS M30, but is UV resistant. It's ideal for end use parts.	✓		Rigid	Ivory, Black, Light Gray, Dark Gray, White, Dark Blue, Green, Yellow, Orange, Red
	ABS M30	Standard ABS created with FDM systems. Properties are identical to ABS injection molded.	✓		Rigid	Ivory, Dark Gray, White, Black, Red, Blue
	ABS-ESD7	ABS thermoplastic with static dissipative properties: prevents static charges from damaging products, or impair their performance.	✓		Rigid	Black
	ABSi	Components made from translucent Absi are penetrable by light. Monitoring of inside fluid movement is allowed.	✓		Rigid	Translucent Natural-Amber-Red
	PC	Polycarbonate. Material with high mechanical resistance, it is suitable for the creation of very strong and definitive models.	✓		Rigid	White
	PC-ISO	Polycarbonate ISO is an ideal material for the food, packaging and medical (certified for medical use) industry.	✓		Rigid	Translucent Natural, White
	PC-ABS	ABS and polycarbonate. Material that combines mechanical and thermal properties of the PC and the flexibility of ABS.	✓		Rigid	Black
	NYLON 12	Nylon 12 has an elongation at break greater than 100-300%. It has high impact resistance and excellent chemical resistance.	✓		Rigid	Black
	NYLON 6	Nylon 6 combines strength and toughness superior to other FDM Thermoplastics, for applications that require strong, customized parts and tooling that lasts longer and withstands rigorous functional testing.	✓		Rigid	Black
	NYLON 12CF	FDM Nylon 12CF™ is a carbon-filled thermoplastic with excellent structural characteristics. The material is comprised of a blend of Nylon 12 resin and chopped carbon fiber, at a loading of 35% by weight.	✓		Rigid	Black
	PPSF	Polyphenylsulfone. Material highly resistant to heat, it can be used in autoclave and it can be sterilized with various methods.	✓		Rigid	Tan
	ULTEM® 9085	Thermoplastic resin with high mechanical and thermal properties. Ideal for parts subject to high stress. Flame retardant.	✓		Rigid	Tan, Black
	ULTEM® 1010	Offering excellent strength and thermal stability with food contact and bio-compatibility certifications; it's ideal for food production tools, custom medical devices, aerospace and automotive applications.	✓		Rigid	Tan
Antero 800NA	Antero™ 800NA is a PEKK-based FDM® thermoplastic. It combines FDM's design freedom and ease of use with the excellent mechanical properties and low outgassing characteristics of the PEKK material.	✓		Rigid	Tan	
HP	HP 3D PA 12	The HP 3D PA 12 material is a highly optimized 3D thermoplastic for high reusability. It allows you to get high-precision models with dimensional tolerances.	✓	✓	Rigid	Black
	PA12 FDA (Food Grade)	The characteristics of PA12 FDA are: high resistance to fats, oils, water, saline solutions and solvents. It is a material suitable for the production of objects that need to come into contact with food (after certification of the process).	✓	✓	Rigid	Black
	HP 3D PA11	PA11 is a thermoplastic material which offers optimal mechanical properties and provides excellent corrosion resistance. Its ductility makes it suitable for the production of components with snap insertions.	✓	✓	Rigid	Gray
	HP 3D PA12 Glass Beads	PA12 Glass Beads material is 40% glass filled and is ideal for applications requiring high stiffness like enclosures, housing and tooling.	✓	✓	Rigid	Black
POLYJET	Vero Blue	Rigid pigmented photopolymer ideal for fine details and dental models.		✓	Rigid	Light Blue
	Vero Black Plus	Black pigmented photopolymer good for unpainted parts; can be finished with soft-touch effect.		✓	Rigid	Black
	Vero Gray	Rigid pigmented photopolymer ideal for highly detailed model seven with thin walls, excellent surface finish.		✓	Rigid	Light Gray
	Vero White Plus	Rigid pigmented photopolymer, slightly flexible and suitable for creating expendable masters for lost-wax casting.		✓	Semi-Rigid	White
	Vero Clear	Transparent photopolymer, ideal for simulating PMMA, PC models or transparent methacrylate.		✓	Rigid	Transparent, Opal
	ABS-Like 2	Pigmented photopolymer particularly suitable for functional models (excellent stability), not suitable for walls <0.8 mm.	✓		Rigid	Light Green
	Helios RGD 525 HT	Very rigid pigmented photopolymer, suitable for applications where thermal stability and extreme detail are required.	✓	✓	Rigid	Ivory
	Full Cure 720	Translucent photopolymer with high accuracy and excellent surface smoothness (certified for medical use).		✓	Rigid	Translucent Amber
	Tango Plus	Elastic photopolymers having 27 Shore A hardness (other hardnesses available).		✓	Elastic	Translucent Amber
	Tango Black Plus	Elastic photopolymers with 27 Shore A hardness (other hardnesses available).		✓	Elastic	Black
	Tango Black	Elastic photopolymer with 60 Shore A hardness (other hardnesses available).		✓	Elastic	Black
Tango Gray	Elastic photopolymer having 70 Shore A hardness (other hardnesses available).		✓	Elastic	Light Gray	
Endur RGD 450	Endur RGD 450 is a tough and flexible photopolymer. It enables you to 3D print precision prototypes that look and behave like injection-molded polypropylene.		✓	Rigid	Ivory	
SLA	Accura® 25	Flexible plastic to simulate and replace CNC machined white polypropylene articles.	✓		Semi-Rigid	White
	Somos® GP Plus 14122	Somos® GP Plus 14122 is a low-viscosity stereolithography resin with an opaque white appearance. This material mirrors production plastics like ABS and PBT and it is easily integrated in production cycles. Somos® GP Plus 14122 is a very versatile material.		✓	Rigid	White
	Accura® ClearVue™	High clarity plastic (transparent) for a multitude of applications.		✓	Rigid	Transparent
	Accura® Xtreme™	Ultra tough grey plastic to replace CNC-machined polypropylene and ABS articles.		✓	Rigid	Gray
	Somos® PerFORM	Somos® PerFORM produces strong, stiff, high temperature resistant composite parts that are ideal for tooling and wind tunnel testing applications.	✓		Rigid	White