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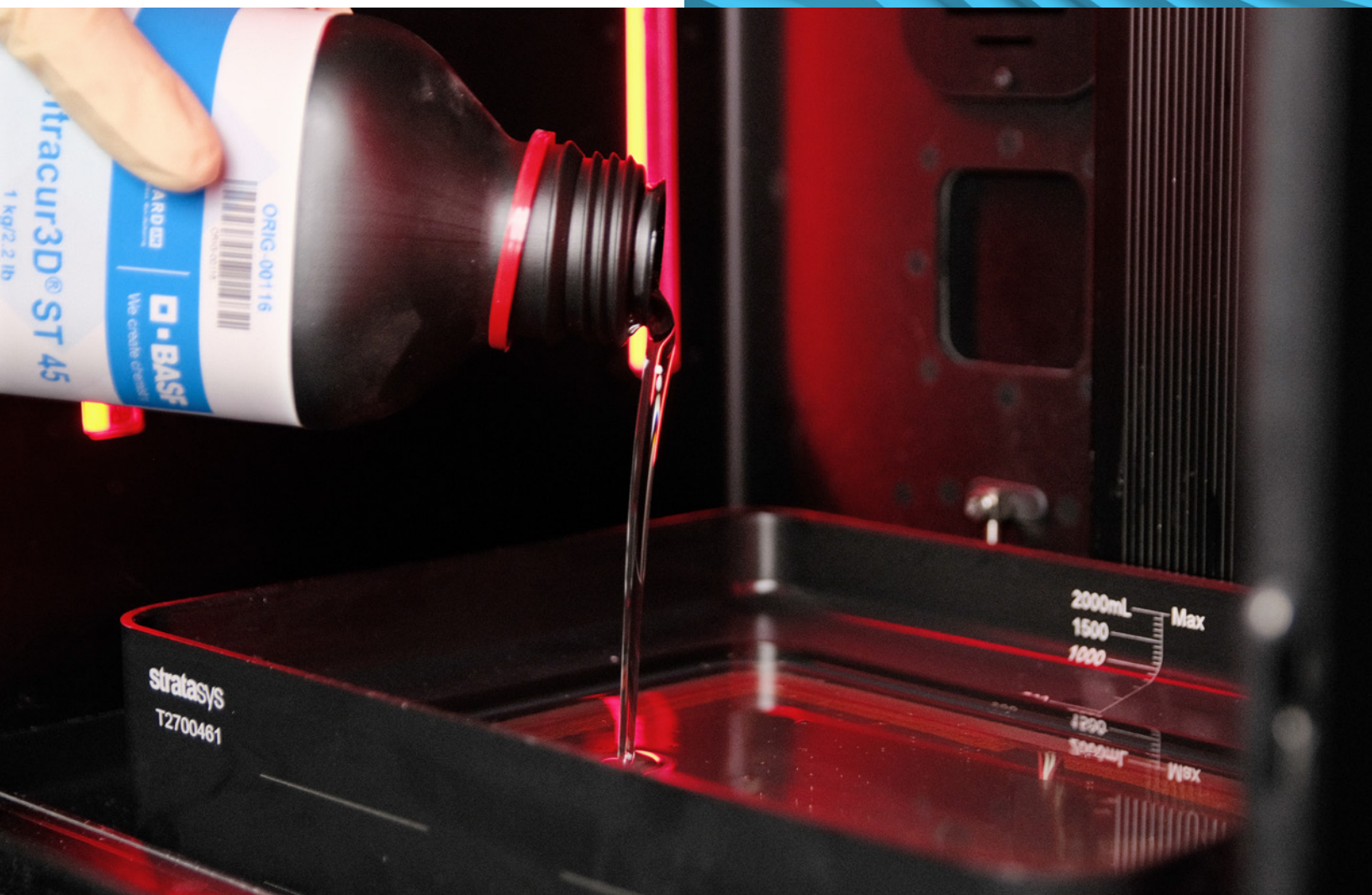
MATERIAL GUIDE
P3™ DLP

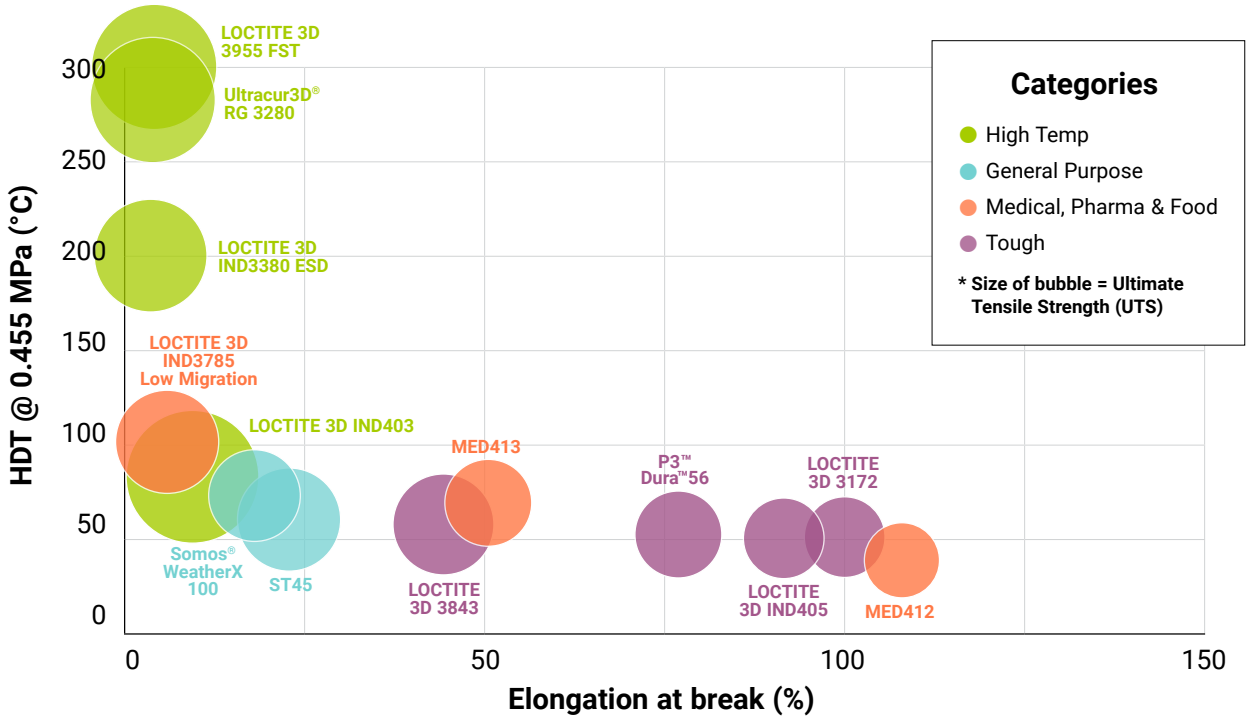
Origin® Materials

Overview of the materials portfolio for P3™ DLP technology with guidance to determine the appropriate material for your application need.

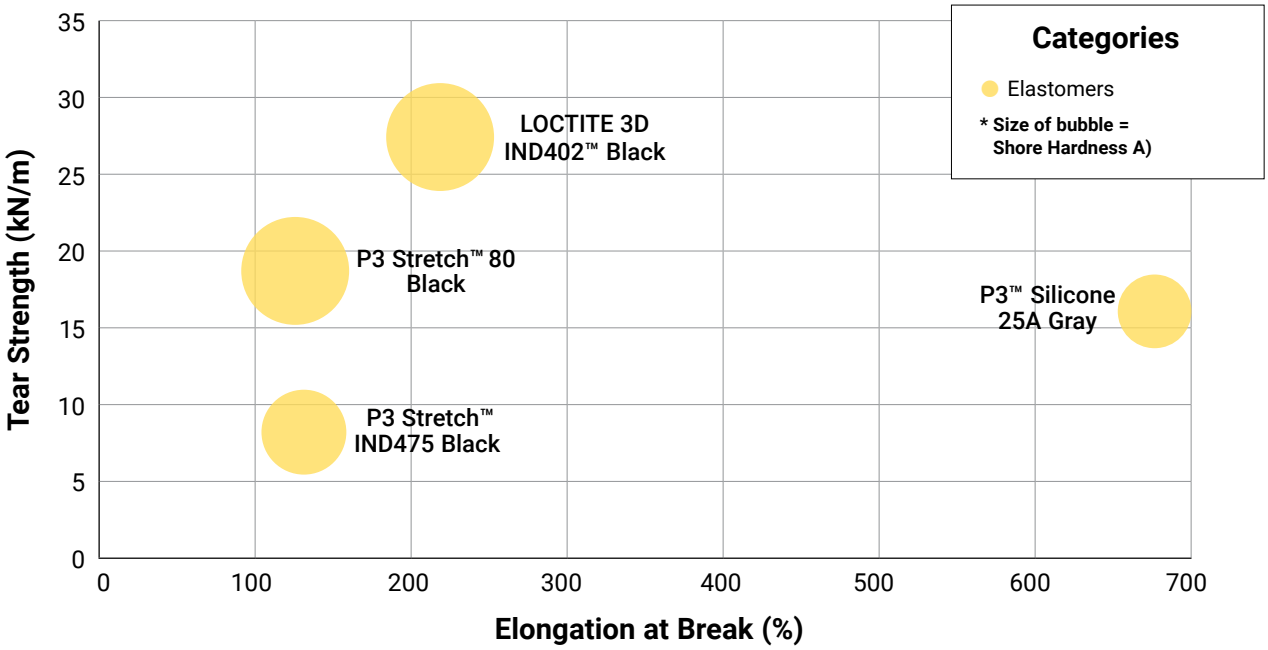


Origin® Preferred & Validated Materials

Overview of General Purpose, High Temperature, Tough, and Medical Materials



Overview of Elastomeric Materials



Preferred, Validated and Open Materials

Origin® users can use a broad range of high-performance materials on their printer. They can choose from three different material categories: Preferred, Validated and Open.

Origin Preferred Materials go through more advanced testing than Validated Materials to achieve:

- Better and repeatable accuracy targets
- First print success rate
- Application-specific profiles
- Relevant certification test results

All Preferred Materials are sold by Stratasys whereas Validated and Open materials may not be.

The following pages show Stratasys Preferred Materials presented by functionality type for easy selection:

- High temperature resistant
- Elastomeric
- Tough
- General purpose
- Medical

Users can work with any material using the OpenAM™ software. Open materials are:

- Printable on the Origin platform
- Come with instructions and calibration parts guiding the user on how to develop own profiles.
- Other information can be found by contacting the material provider

More information on the OpenAM software and materials can be found further in this document.

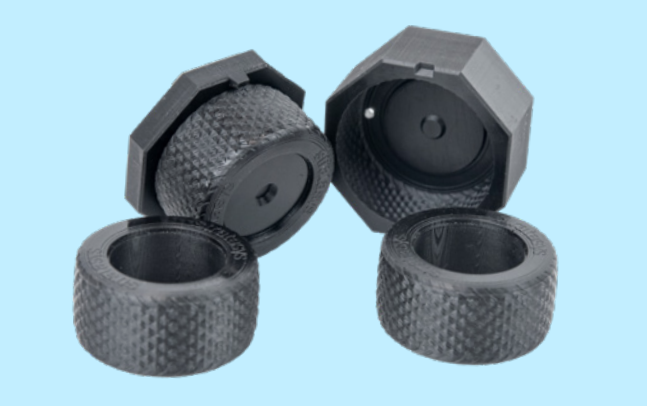
	Preferred	Validated	Open
Green profile • EcDp • Cleaning optimization • Cure optimizatio	✓	✓	Provided by material supplier
XY and Z scale factors	✓	✓	
Edge compensation	✓	✓	
MPG	✓	✓	
TDS	✓	✓	
Print quality testing • Repeatability • Printability • Accuracy	✓	✓	
Application-specific profiles	Varies		
Sold by Stratasys	✓	✓	Material supplier
Technical support	Stratasys	Stratasys	Material supplier

High-Temperature-Resistant Materials

Many applications across industries require materials to have high resistance to breaking down or deforming at high temperatures. Some key examples include injection/ urethane molds, fluid adapters, and electrical connectors.

Special in the Origin portfolio is Loctite 3D 3955™ from Henkel featuring FST certification and UL-94 V0 at 3mm thicknesses. Due to its ability to consistently heat to and maintain the chamber at 60°C, Origin is the only printer that has Blue Card certification with the 3955 FST material.

Note: our definition of a "high temperature resistance material " as having a HDT greater than 80 °C.



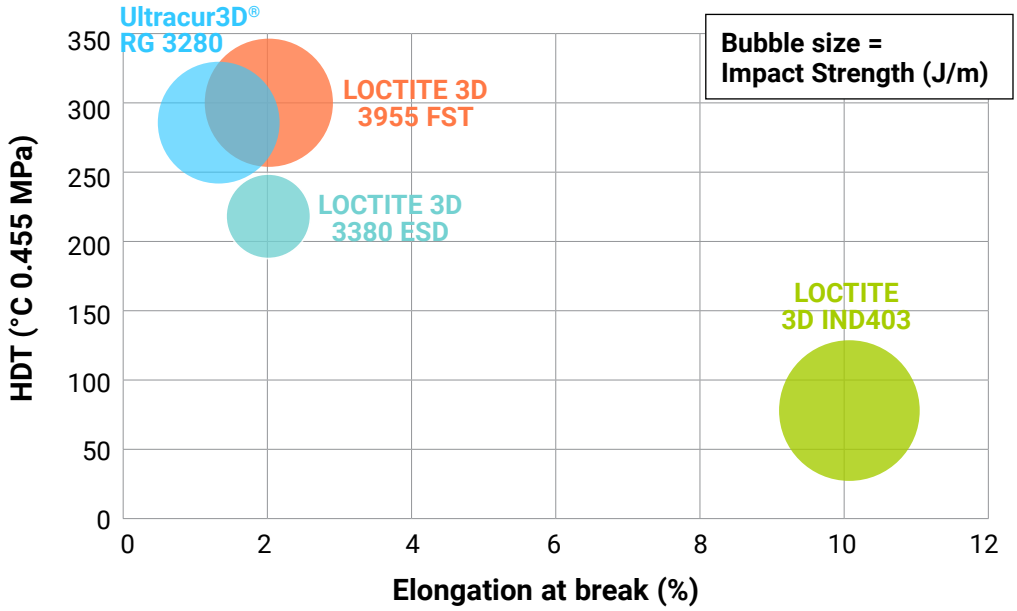
* Most popular with Origin users

Material	HDT	Elongation at Break	Impact Strength	Water Absorption (24 hour)	Other	Colors	Thermoplastic Analogue
Loctite 3D 3955* FST	300 °C (572 °F)	2%	23 J/m (0.43 ft·lb/in)	0.3%	FST rated	■	Ultem, PBT
Loctite 3D IND3380™ ESD	200 °C	2%	12 J/m (0.22 ft·lb/in)	0.59 %	ESD	■	PEKK
Loctite 3D IND403™	80 °C (176 °F)	10%	27 J/m (0.51 ft·lb/in)	1.8%	-	■	Nylon 6/6
Ultracur3D® RG 3280	284 °C (543 °F)	1.3%	24 J/m (0.45 ft·lb/in)	0.29%	≈ 65 wt% silica	□	Metal

High-temperature-resistant materials tend to be more brittle in comparison with other classes of materials.

Customers should avoid using high-temperature-resistant materials for applications where impact or risk of dropping is high.

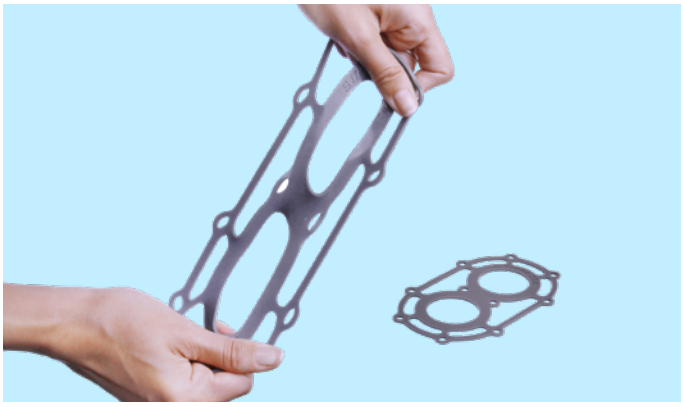
Additionally, these materials tend to have higher moisture resistance which typically leads to better dimensional and long-term property stability.



Elastomeric Materials

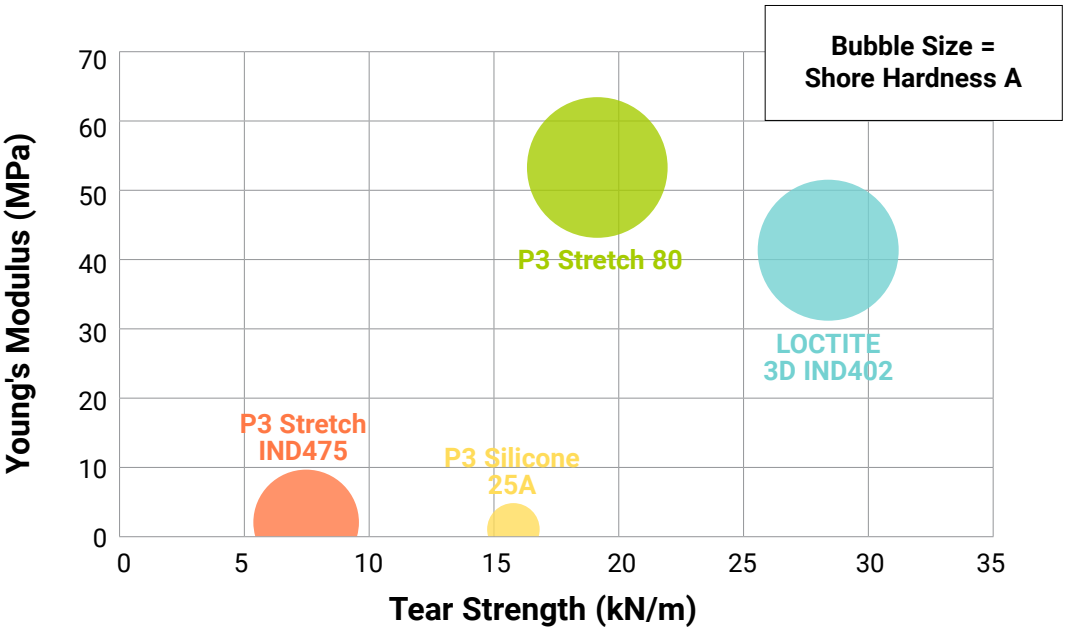
Rubber-like materials and 3D printing are no obvious combination. The Origin platform is the best option across all polymer technologies – photopolymer or thermoplastic – for handling high viscosity materials and producing accurate elastomeric parts with high performance properties.

Elastomeric materials come in many different flavors based on shore hardness, resilience, modulus, and other properties to cater to support and enable the specific application. Origin provides users with four elastomeric options – three photopolymers and one **silicone** - to address applications from sealing to cushioning to specialty compliance use-cases.

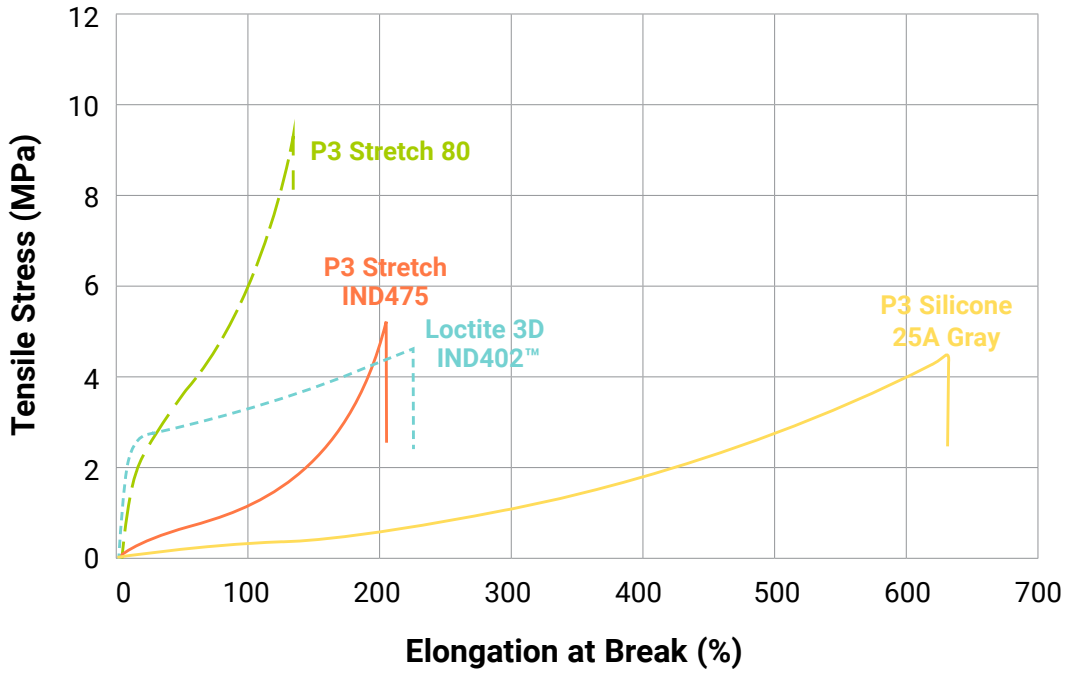


Material	Tear Strength	E Modulus	Elongation at Break	Water Absorption (24 hour)	Shore Hardness	Viscosity	Compliance	Colors	Thermoplastic Analogue
Loctice 3D IND402™	28 kN/m (160 lb·F/in)	42 MPa (0.43 ft·lb/in)	230%	3.6%	85A	15,000 cP	Irritation ISO 10993-23	■	85-95A TPU
P3™ Silicone 25A	16 ± 3 kN/m (91 lb F/in)	1.45 MPa	672%	1.5%	25A	17,000 cP	Biocompatibility (Cytotoxine ISO 10993-5; Pending)	■	Low durometer TPU
P3™ Stretch™ IND475	7.5 kN/m (43 lb·F/in)	2.5 MPa (0.28 ft·lb/in)	122%	3.2%	48A	1,500 cP	Irritation ISO 10993-23	■	Low durometer TPU
P3™ Stretch™ 80	19 kN/m (108 lb·F/in)	54 MPa (0.51 ft·lb/in)	117%	2.1%	80-85A	500 cP		■	80-90A TPU

Elastomeric Materials



Higher Young's Modulus values indicate that the material is stiffer and has a higher Shore Hardness value. Elastomers with higher stiffness are generally more resistant to tearing.



A stress-strain curve of the four elastomers show their difference in physical behavior.

Loctite 3D IND402 and P3 Stretch 80 show high initial resistance to stretching meaning these are more resilient and have more "springiness".

P3 Stretch IND475 shows low resistance until breakage indicating it is a softer-touch material.

P3 Silicone 25A shows similar behavior, though it is even softer with a much higher elongation before breaking.

Tough Materials

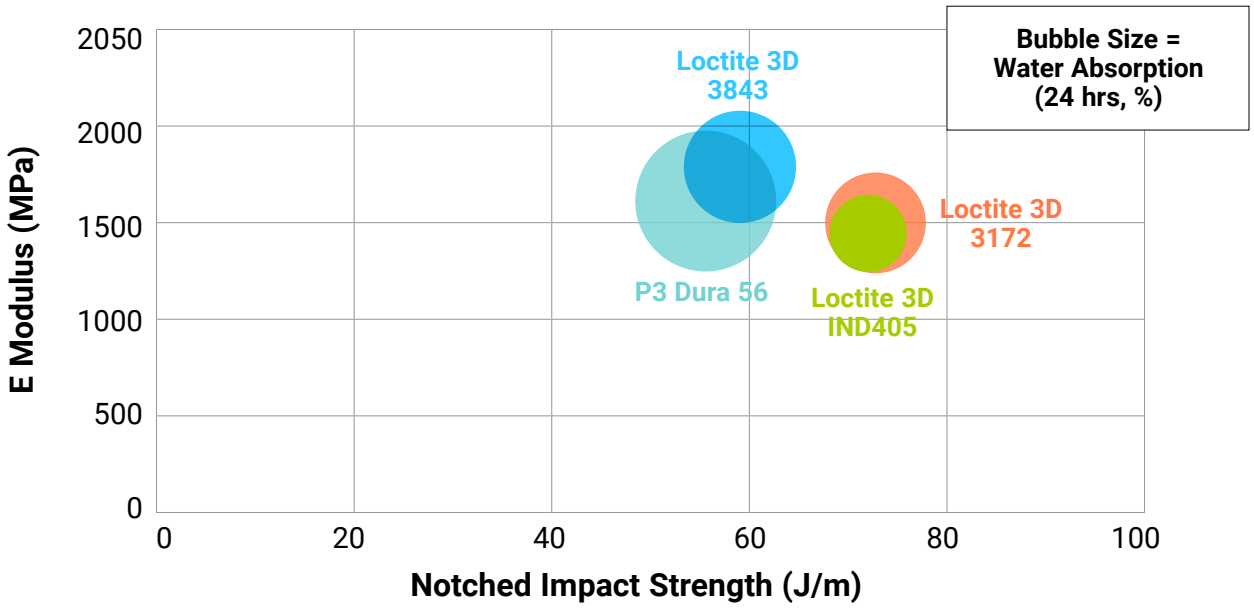
A material's toughness can be described using a variety of different properties and parameters. Our definition of a "tough material" is generally having an impact strength greater than 50 J/m.

Many applications across various industries require tough materials to withstand impact, like a jig being dropped onto the floor, or repetitive motions, like a latch which opens and closes repeatedly. Other example applications where tough materials would be a good choice include housings and industrial adapters or shims.

Unique to our portfolio is Stratasys Dura™ 56 – a high performing material exclusive to Origin and positioned at a more cost-effective price point.

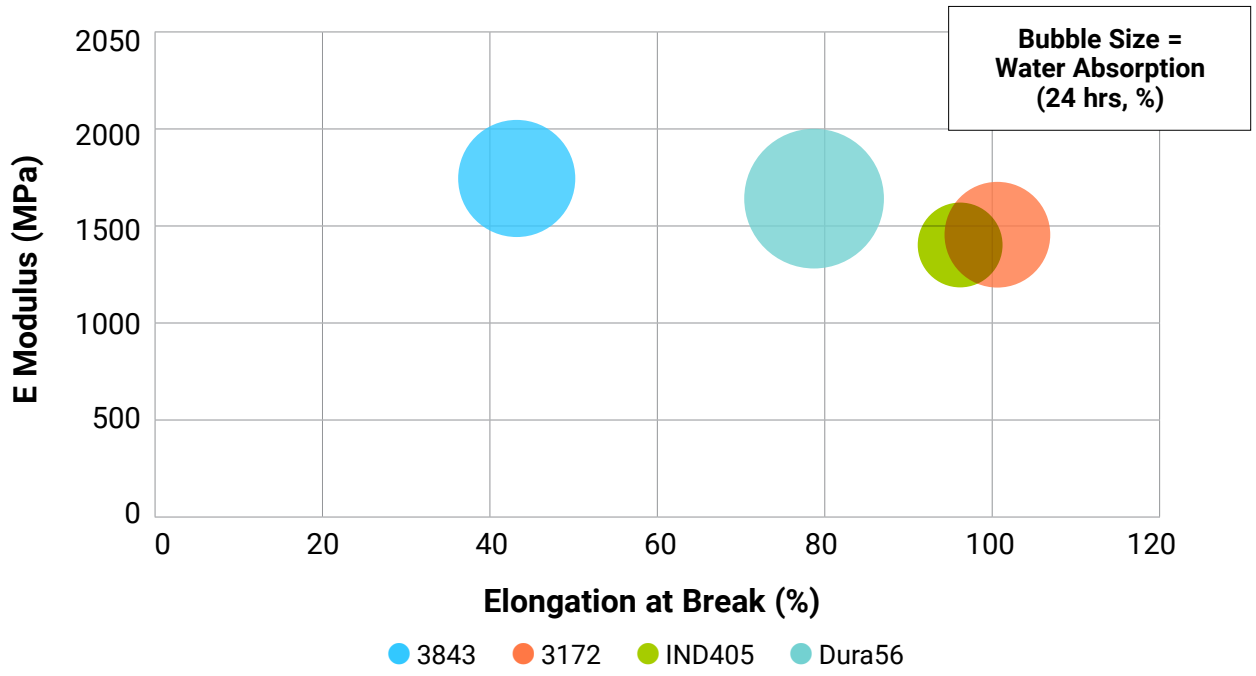
Material	Impact Strength	E Modulus	Elongation at Break	HDT	Moisture Absorption	Viscosity	Colors	Thermoplastic Analogue
Loctite 3D 3843	59 J/m (1.11 ft·lb/in)	1,750 MPa (254 ksi)	44%	63 °C (145 °F)	2.0%	800 cP	■▨□	ABS
Loctite 3D 3172™	73 J/m (1.37 ft·lb/in)	1,500 MPa (218 ksi)	100%	52 °C (124 °F)	1.7%	1850 cP	■■	Impact modified polypropylene
Loctite 3D IND405™	72 J/m (1.35 ft·lb/in)	1,434 MPa (208 ksi)	96%	53 °C (129 °F)	1.0%	2300 cP	□	Impact modified polypropylene
P3™ Dura56	56 J/m (1.05 ft·lb/in)	1,600 MPa (232 ksi)	78%	52 °C (126 °F)	3.0%	920 cP	■	ABS

Tough Materials



Origin has a robust portfolio of tough materials featuring different colors, performance profiles, and cost points. The three materials shown above are good choices for parts and applications in high impact environments (manufacturing jigs) or frequently opened and closed (latches).

There is a general rule of thumb regarding temperature resistance and brittleness or toughness: high-temperature-resistant materials tend to be more brittle, and more elastic or tough materials tend to have lower temperature resistance. This should be kept in mind when determining the material best suited for your application.



General Purpose Materials

General purpose materials are recommended for applications that require good, all-around performance, are easy to print and process, or both. New and experienced users prefer them for their ease of printing as well as wide applicability across diverse use-cases. That makes these materials also a good choice for initial testing and for applications with relatively low requirements.

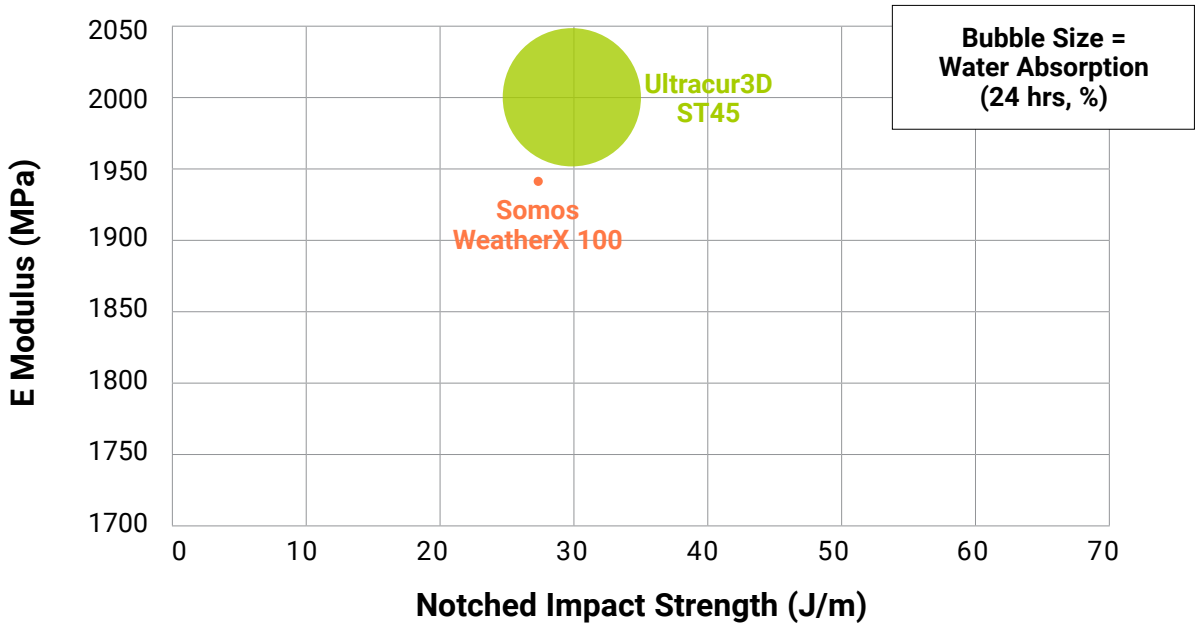
Noteworthy in this group is Somos® WeatherX 100 – a proven, high-performing material combining best-in-class UV resistance and improved chemical resistance with very low moisture absorption.

Ultracur3D® ST45 is an easy-to-use, high performing, and cost-effective material option.

> Somos WeatherX 100 has been our go-to option for a lot of the miscellaneous components”

Major Automotive OEM partner

Material	Impact Strength	E Modulus	Elongation at Break	Moisture Absorption	HDT	Viscosity	Colors	Thermoplastic Analogue
Somos® WeatherX 100	27 J/m (0.51 ft·lb/in)	1,943 MPa (282 ksi)	19%	0.4%	73 °C (163 °F)	950 cP	■	UV-stabilized thermoplastics
Ultracur3D ST45	30 J/m (0.56 ft·lb/in)	2,000 MPa (290 ksi)	21%	5.0%	63 °C (145 °F)	320 cP	■ □	ABS



Medical, Pharma and Food Materials

Additive manufacturing has many applications within the medical industry, taking advantage of the ability to rapidly test and produce tooling or end-use parts.

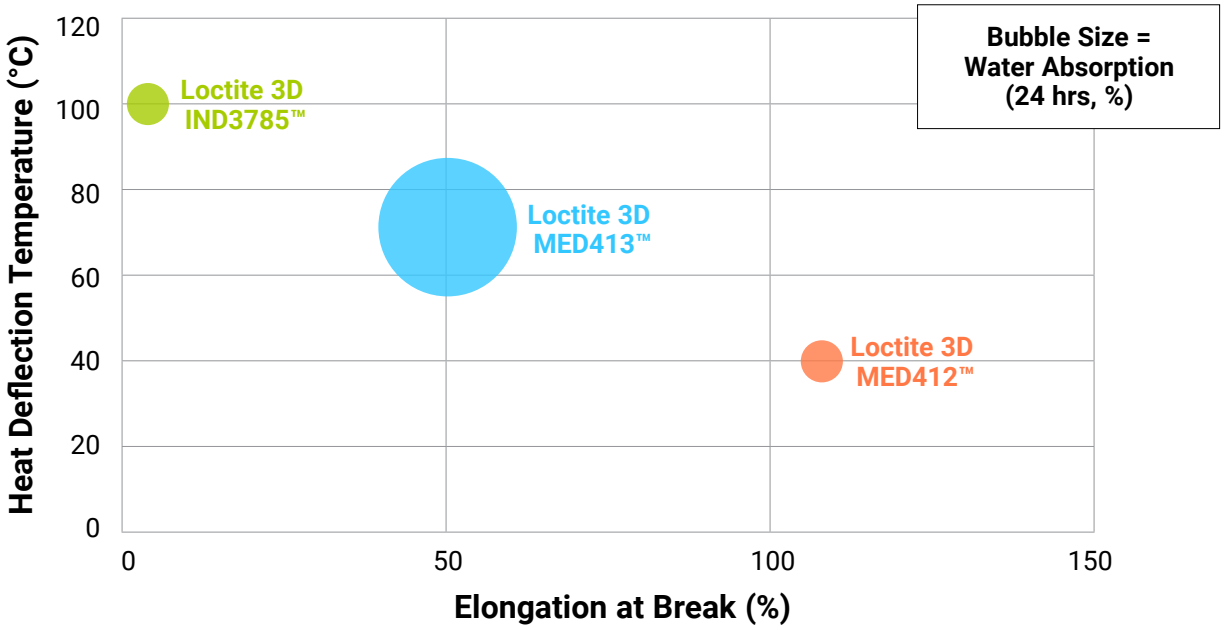
Origin's portfolio contains two medical-specific materials – Loctite 3D MED412™ and Loctite 3D MED413™, both with ISO 10993-5/10/23 approvals – capable of meeting requirements for medical device equipment components, orthotics/prosthetics, and other applications.

Consider Loctite® 3D MED413 for applications and parts requiring higher temperature resistance and stiffness such as surgical guides and medical device components.

Loctite® 3D MED412 is a good option for applications requiring very low water absorption and high toughness, like nasal swabs, catheter tips, and single-use medical devices.

The low migration material Loctite 3D IND3785 complies with EU10/2011 and is undergoing certification under FDA CFR177.1010.

Material	Impact Strength	E Modulus	Elongation at Break	Moisture Absorption	HDT	Colors	Thermoplastic Analogue
Loctite 3D MED412	50 J/m (0.94 ft·lb/in)	1,300 MPa (189 ksi)	110%	0.27%	40 °C (104 °F)	☐	Impact modified polypropylene
Loctite 3D MED413	27 J/m (1.12 ft·lb/in)	1,600 MPa (232 ksi)	50%	2.7%	70 °C (158 °F)	☐ ▨	UV-stabilized thermoplastics
Loctite 3D IND3785 Low Migration	22 J/m (0.41 ft·lb/in)	2,500 MPa (363 ksi)	5%	0.3%	100 °C (212 °F)	☐	ABS, PA12, PBT-like



What are Open Materials?

Open materials include materials that bring unique material properties. They complement Stratasys' Preferred and Validated materials portfolio by enabling new and advanced applications.

Open Materials for Origin are available to end-users who purchased OpenAM™ software. Once the OpenAM software is purchased, the pre-made material profiles are immediately available in the Origin software and ready for printing. Although Origin users are free to print any material, the intention of having pre-made profiles is to simplify and accelerate the process of creating a profile and begin printing.

OpenAM software

The OpenAM software provides greater control over the printing process by expanding the list of changeable print parameters. OpenAM software users are given a one-time training on how to use the tool and have expanded coverage for non-certified material on the service contract.

OpenAM software users can run any material they want with the software, including materials not on the Open Materials list, like materials developed in-house.

The standard Origin warranty for the printer itself remains in place, also under use with Open Materials.

Open Materials vs Preferred and Validated Materials

- Pre-made profiles were developed by the material supplier based on their recommendations and experience. Stratasys did not perform additional testing nor did it align these profiles to any specific standard.
- Profiles may change and improve over time based on the material supplier's request.
- The material supplier is responsible for ensuring all required documentation and setup is available for interested end users. This includes SDSs, TDSs, regulatory compliance, material stocking, and so on.
- Open Materials may have additional or different design considerations, workflows, and post-processing steps. OpenAM users are encouraged to contact material suppliers for support and conduct their own internal testing to determine optimal settings and workflows.
- OpenAM users can reach out to the material suppliers and their resellers directly. These materials are not stored or distributed by Stratasys.
- Stratasys only provides benchmark parts and support for preferred and validated materials, not for parts in Open Materials. Please contact the material supplier for benchmarking material requests.

Open Materials List – For Use With OpenAM™ Software

Material name	Description	Ultimate tensile strength	Elongation at break	Tensile modulus	HDT	Notched Izod impact	Hardness	Colors	Consider replacing	Supplier	Spec Sheet
RG 1100 B	High temp	70 MPa	5%	2,950	100 °C	21 J/m	84D	Black	Nylon 6, PBT	Forward AM	Forward AM
RG 1100	High temp	70 MPa	5%	3,080	116 °C	16 J/m	85D	Clear	Nylon 6, PBT	Forward AM	Forward AM
IND147	High temp	67 MPa	2%	3,190 Mpa	290 °C	14.6 J/m	94 D	Black	PEEK	Henkel	LOCTITE AM
IND249	High temp	98 MPa	5%	3,300 Mpa	115 °C	24 J/m	88 D	Black	Nylon 6	Henkel	LOCTITE AM
IND406	High temp	55 MPa	25%	1,600 Mpa	107 °C	40 J/m	79 D	Black	3D printed Nylon 12	Henkel	LOCTITE AM
N3D-HT511	High temp	54 MPa	7%	2,400 Mpa	130 °C	–	–	Black	Nylon 6, PBT	Sartomer	Sartomer
N3D-FR512	High temp, FR rating	42 MPa	4%	5,100 Mpa	170 °C	–	–	–	FR engineering plastic, Nylon 6, PBT		Sartomer
RG 9400 B FR	High temp, FR rating	78 MPa	3%	3,900	255 °C	20 J/m	88D	Black	FR engineering plastic, Nylon 6, PBT	Forward AM	Forward AM
Formula One	ESD; High stiffness	95 MPa	5.3%	3,300 MPa	–	22 J/m	88 D	Black	Static ESD materials	Mechnano	Mechnano F1
CAST 245	Specialty; I.C. patterns	900 MPa	4%	12.5 MPa	–	–	–	Purple	Investment Casting Material	Arkema	Arkema N3D-CAST245
N3D-TOUGH784	Tough	50 MPa	45%	2,020 Mpa	56 °C	–	–	Black	ABS	Sartomer	Sartomer
IND6845	Tough	48 MPa	40%	2,100 Mpa	80 °C	30 J/m	82D		ABS	Henkel	LOCTITE AM
ST 7500 G	Tough	54 MPa	13%	2,300 Mpa	54 °C	25 J/m	82 D	–	ABS	Forward AM	Forward AM
IND5714	Elastomer	3 MPa	143%	4.9 MPa	–	–	53 A	Grey	Low durometer TPU	Henkel	LOCTITE AM
FL 300	Elastomer	5 MPa	245%	–	–	–	40 A	Clear	Low durometer TPU/ silicon with ISO10993-5 and ISO10993-10	Forward AM	Forward AM
EL 60	Elastomer	9 MPa	95%	–	–	–	75 A	Clear	High durometer TPU/ silicon with ISO10993-5 and ISO10993-10	Forward AM	Forward AM
MED414	Medical; Elastomer	4 MPa	240%	4 MPa	–	–	51 A	Blue	Low durometer medical TPU	Henkel	LOCTITE AM
MED9851	Medical, High stiffness	45 MPa	40%	2,300 Mpa	68 °C	50 J/m	81 D	clear	Medical ABS	Henkel	LOCTITE AM
MED3394	Medical; High temp	76 MPa	14%	2,300 MPa	100 °C	26 J/m	75 D	Black, White	Sterilizable products	Henkel	LOCTITE AM
PRO410	General purpose	48 MPa	5%	1,900 Mpa	76 °C	28 J/m	84 D	Black	Prototyping parts	Henkel	LOCTITE AM
PRO417	General purpose	40 MPa	100%	1,300 Mpa	49 °C	54 J/m	73 D	Black	Polypropylene	Henkel	LOCTITE AM
PRO476	General purpose	42 MPa	60%	1,700 Mpa	62 °C	45 J/m	78 D	Black	Polypropylene	Henkel	LOCTITE AM
PRO9274	General purpose	33 MPa	7%	1,500 Mpa	52 °C	26 J/m	80 D	Grey	Prototyping parts	Henkel	LOCTITE AM
N3D-PR184-BIO	General purpose; bio	32 MPa	7%	1,970 Mpa	81 °C	–	–	–	Prototyping parts	Sartomer	Sartomer
ST 7500 G	General purpose	54 MPa	13%	2,300 Mpa	64 °C	25 J/m	82 D	Grey	ABS, delrin with ISO10993-5 and ISO10993-10	Forward AM	Forward AM
RG 35 B	Rigid	62 Mpa	10%	2,600 Mpa	87 °C	21 J/m	83 D	Black	Nylon 6, PBT with ISO10993-5	Forward AM	Forward AM
RG 35	Rigid	80 Mpa	6%	2,600 Mpa	83 °C	23 J/m	85 D	Clear	Nylon 6, PBT with ISO10993-5 and ISO10993-10	Forward AM	Forward AM

Open Materials List –
For Use With OpenAM™ Software

Material name	Description	Ultimate tensile strength	Elongation at break	Tensile modulus	HDT	Notched Izod impact	Hardness	Colors	Consider replacing	Supplier	Spec Sheet
Strong-X	High stiffness	84 MPa	6%	3,500 MPa	73 °C	17 J/m	90 D	Grey	Nylon 6, PBT	Liqcreate	Liqcreate Strong-X