

FDM TPU 92A

FDM® TPU 92A is a thermoplastic polyurethane with a Shore A value of 92. The material exhibits high elongation, superior toughness, durability and abrasion resistance.

FDM TPU 92A brings the benefits of elastomers to FDM 3D printing and offers the capability to quickly produce large and complex elastomer parts. Typical applications include flexible hoses, tubes, air ducts, seals, protective covers and vibration dampeners.

FDM TPU 92A is available on the F123 and F123CR (composite-ready) Series 3D printers and is compatible with QSR™ soluble support material.

| Mechanical Properties | Test Method | Value | |
|---|-------------|---------------------------|-------------------------|
| | | XY Orientation | XZ Orientation |
| Shore Hardness (molded) | ASTM D2240 | 92 Shore A | 92 Shore A |
| Tensile Strength, Yield (Type 1, 0.125", 0.2"/min) | ASTM D412 | 15.6 MPa (2,265 psi) | 16.1 MPa (2,332 psi) |
| Tensile Strength, Ultimate (Type 1, 0.125", 0.2"/min) | ASTM D412 | 16.8 MPa (2,432 psi) | 17.4 MPa (2,519 psi) |
| Tensile Modulus (Type 1, 0.125", 0.2"/min) | ASTM D412 | 15.3 MPa (2,212 psi) | 20.7 MPa (3,000 psi) |
| Elongation at Break (Type 1, 0.125", 0.2"/min) | ASTM D412 | 552% | 482% |
| Elongation at Yield (Type 1, 0.125", 0.2"/min) | ASTM D412 | 466% | 385% |
| Tensile Stress at 100% Elongation (PSI) | ASTM D412 | 6.9 MPa (999 psi) | 7.6 MPa (1,096 psi) |
| Tensile Stress at 300% Elongation (PSI) | ASTM D412 | 11.0 MPa (1,598 psi) | 11.9 MPa (1,722 psi) |
| Flexural Strength (Method 1, 0.05"/min) | ASTM D790 | 1.8 MPa (255 psi) | 2.4 MPa (351 psi) |
| Flexural Modulus (Method 1, 0.05"/min) | ASTM D790 | 25.6 MPa (3,719 psi) | 36.9 MPa (5,349 psi) |
| Flexural Strain at Break (Method 1, 0.05"/min) | ASTM D790 | No break | No break |
| Tear Strength - Stamped | ASTM D624-C | 84.6 N/mm (483 lbF/in) | NA |
| Compressive Strength, Yield (Method 1, 0.05"/min) | ASTM D695 | 2.6 MPa (384 psi) | 2.6 MPa (384 psi) |
| Compressive Strength, Ultimate (Method 1, 0.05"/min) | ASTM D695 | 2.6 MPa (384 psi) | 2.6 MPa (384 psi) |
| Compressive Modulus (Method 1, 0.05"/min) | ASTM D695 | 16.9 MPa (2,457 psi) | 16.9 MPa (2,457 psi) |
| Compression Set at 22 Hours @ 23 °C | ASTM D395 | 21% | NA |
| Compression Set at 22 Hours @ 70 °C | ASTM D395 | 44% | NA |

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| Thermal Properties | Test Method | Value |
|--|-------------|--|
| Heat Deflection (HDT) @ 66 psi | ASTM D648 | 38 °C (100.4 °F) |
| Heat Deflection (HDT) @ 15 psi | NA | 56 °C (132.8 °F) |
| Vicat Softening Temperature (Rate B/50) | ASTM D1525 | 95 °C (203 °F) |
| Glass Transition Temperature (Tg) | DMA (SSYS) | -42 °C (-43.6 °F) |
| Coefficient of Thermal Expansion (x-direction) | ASTM E831 | 139 µm/(m·°C) (7.72E-05 in/(in·°F)) |
| Coefficient of Thermal Expansion (y-direction) | ASTM E831 | 159 µm/(m·°C) (8.83E-05 in/(in·°F)) |
| Coefficient of Thermal Expansion (z-direction) | ASTM E831 | 176 µm/(m·°C) (9.78E-05 in/(in·°F)) |

| Electrical Properties | Test Method | Value | |
|-----------------------|-------------|-----------------|-----------------|
| | | XY Orientation | XZ Orientation |
| Volume Resistivity | ASTM D257 | 6.09E+10 ohm-cm | 7.17E+13 ohm-cm |

| Other | Test Method | Value |
|------------------|-------------|---------|
| Specific Gravity | ASTM D792 | 1.13502 |

UV Aging

FDM TPU 92A was tested before and after UV exposure. Ten ASTM D638 upright (XY) dogbones were tested in tensile after UV exposure and an additional 10 ASTM D638 XY dogbones were the control (No UV Exposure). The UV exposed samples were cycled in the QUV chamber per ASTM G154 (Standard Practice for Operation Fluorescent Light Apparatus for UV exposure of Nonmetallic Materials) for 1000 hours, alternating for 8 hours at 60 °C (140 °F) and 4 hours at 50 °C (122 °F) with humidity and condensation. The increase in ultimate strength is from the control samples. For more information see the [Impact of UV Exposure on FDM Materials](#) white paper.

| Conditioning | Yield Strength | Ultimate Strength | Elongation at Ultimate Strength | Increase in Ultimate Strength | Modulus |
|----------------|---------------------|---------------------|---------------------------------|-------------------------------|-----------------------|
| No UV Exposure | 18.8 MPa (2730 psi) | 18.9 MPa (2740 psi) | 512% | | 0.0223 GPa (3.23 ksi) |
| UV Exposure | 16.0 MPa (2330 psi) | 16.0 MPa (2330 psi) | 470% | -15.30% | 0.0218 GPa (3.16 ksi) |

FDM TPU 92A coupons were built on the F370 using the F123 Elastomeric Head.

The information presented are typical values intended for reference and comparison purposes only. They should not be used for design specifications or quality control purposes. End-use material performance can be impacted (+/-) by, but not limited to, part design, end-use conditions, test conditions, etc. Actual values will vary with build conditions. Tested parts were built on a Stratasys F370™ @ 0.010" (0.254 mm) slice.

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