

Averatek enables this 3-D printing, which is not possible with traditional fabrication processes.

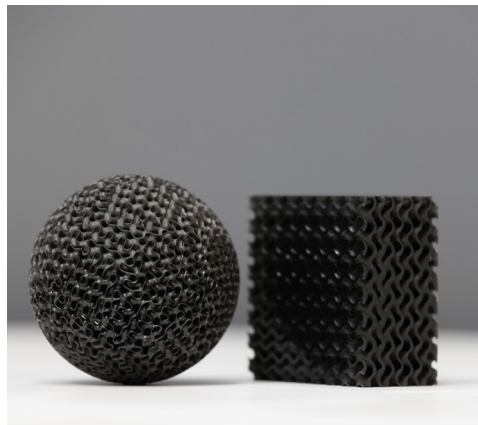
Radix™ Printable Dielectric

3D-Printable Dielectric Material for use on Fortify FLUX Series Printers

Radix™ Printable Dielectrics are the industry's first low loss DLP and stereolithography (SLA) 3D-printable material. By combining a low loss resin system with the design freedom and speed of DLP 3D-printing, this technology enables the scalable manufacturing of new RF components that cannot be made with traditional manufacturing processes. The printable materials leverage the performance of DLP and SLA printing processes to allow antenna engineers to implement new dielectric components in applications such as SATComm antenna lenses and volumetric circuits for mmWave frequencies.

Radix Printable Dielectric also enables the use of Gradient Index (GRIN) dielectric components with little added complexity. The solid 2.8 dielectric constant

material has a dissipation factor of 0.0043 at 10 GHz, and can be used to create structures that have a graded dielectric constant in all three dimensions by means of a varying density lattice. These latticed structures provide even lower dissipation factor and weight when compared against a similar part made with solid materials.



!!! Features and Benefits:

Industry first low loss 3D-printable photopolymer with loss tangent of 0.0043 @ 10 GHz. Dielectric constant of 2.8 @ 10 GHz

- Ensures high efficiency in large lenses and antenna structures

Robust thin-walled printing capability down to 225 microns

- Enables lattice structures for use up to at least 40 GHz

Create structures that spatially vary in dielectric constant from 1.15 to 2.0 with a one-material system

- Enables wideband, field-of-view enhancing lenses, and switch-beam steering antenna systems for mmWave applications

!!! Typical Applications:

- Gradient Index (GRIN) or Gradient Dielectric Constant Lenses
- 3D Antenna Systems
- Impedance matching structures
- Rapid Prototyping of radomes and other components

Fortify's FLUX series printers powered by a DLP (Digital Light Processing) engine, combine the scalability, resolution, and surface quality of photopolymers with the performance expectations of traditional high performance polymers. CKM (Continuous Kinetic Mixing), a proprietary subsystem built into the printers, enables printing of photopolymer resins with uniformly distributed functional additives. The system ensures that particles stay uniformly suspended instead of agglomerating or settling to the bottom of the vat. CKM allows for an expanded processing window compared to other photopolymer DLP or SLA systems, processing much higher viscosity materials. Fortify partners with Rogers Corporation and other global chemical companies to extend material properties and solve printability challenges. www.3dfortify.com

Properties	Typical Values ⁽¹⁾	Direction	Units	Test Conditions		Test Method
Electrical Properties						
Dielectric Constant	2.8	Z	-	23°C @ 50% RH	10 GHz	IPC-TM-650 2.5.5.5
	2.8	Z	-	23°C @ 50% RH	24 GHz	IPC-TM-650 2.5.5.5
Dissipation Factor	0.0043	Z	-	23°C @ 50% RH	10 GHz	IPC-TM-650 2.5.5.5
	0.0046	Z	-	23°C @ 50% RH	24 GHz	IPC-TM-650 2.5.5.5
Volume Resistivity	1.9 X 10 ¹⁵	-	ohm-cm	-	-	ASTM D257
Surface Resistivity	1.8 X 10 ¹⁵	XY	ohm/sq	-	-	ASTM D257
Electrical Strength (dielectric strength)	446	Z	V/mil	-	-	IPC TM-650 2.5.6.2
Thermal Properties						
Decomposition Temperature (Td)	313	-	°C	2hrs @ 105°C	5% Weight Loss	IPC TM-650 2.4.24.6
Coefficient of Thermal Expansion	76, 75	XY, Z	ppm/°C	-	-50°C to 50°C	IPC TM-650 2.4.41
Coefficient of Thermal Expansion	123, 120	XY, Z	ppm/°C	-	50°C to 250°C	IPC TM-650 2.4.41
Thermal Conductivity	0.3	Z	W/(m·K)	50°C	-	ASTM D5470
Mechanical Properties						
Tensile Stress at Break	38	XY	MPa	-	-	ASTM D638
Elongation at Failure	2.3	XY	%	-	-	ASTM D638
Young's Modulus	2.7	XY	GPa	-	-	ASTM D638
Heat Deflection Temperature @ 0.455 MPa	76.7	-	°C	-	-	ASTM D648
Heat Deflection Temperature @ 1.82 MPa	59.1	-	°C	-	-	ASTM D648
Physical Properties						
Color	Dark blue/black	-	-	-	-	-
Flammability	HB	-	-	-	-	UL 94
Moisture Absorption	0.08	-	wt %	D24/23	-	ASTM D570
Specific Gravity	1.36	-	-	23°C	-	ASTM D792

¹Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corporation.

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