FORTIFY

TECHNICAL CERAMIC 3D PRINTING

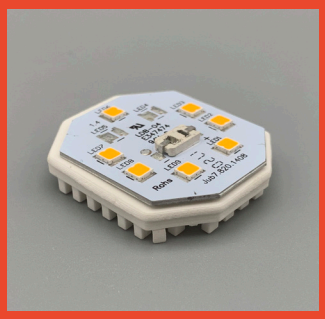
LOW SHRINK, HIGH PERFORMANCE TECHNICAL CERAMICS

Fortify and Tethon 3D have partnered to introduce a new generation of technical ceramic photoresins exhibiting the industry's lowest shrink rates during sintering. These materials are optimized for high throughput and high resolution on Fortify's FLUX CORE 3D printer.

Shrink is minimized across materials leveraging key technology from each company. Tethon has advanced IP that enables very high loading of resins, which Fortify has the unique ability to process. By limiting shrink in the sintering process, Fortify ceramic materials can be used confidently on a wide range of geometries including large parts and thick cross sections with tight tolerances.

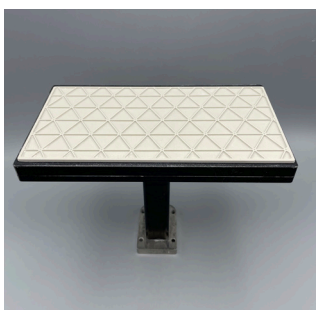
Fortify's palette of Ceramic materials is expanding rapidly. We can also work with your team to develop custom solutions for your ceramics challenges.

A 3D printed ceramic graded refractive index (GRIN) lens printed on the FLUX CORE pinter with High Purity Alumina (99.8%) (HP-A 99.8) resin.



A 3D printed electronics heat sink manufactured from Fortify High Purity Alumina (99.8%) (HP-A 99.8) features high thermal conductivity and stability

3D printed rocket nozzles printed from Fortify Low Shrink Aluminum Silicate (LS-AS) that exhibits that exhibits temperature stabilities up to 1750°C and shrinkage as low as 4.7%



The isogrid geometry, typically prohibitively expensive to manufacture, is easily printed in the Fortify Low Shrink Aluminum Silicate (LS-AS) material.

QUALIFIED MATERIALS

Fortify High Purity Alumina (99.85%) (HP-A 99.8) is an alumina-filled photoresin that sinters to a final part purity of 99.8% alumina with only 12% shrinkage. This is a great selection for applications that require high reliability, dielectric strength, corrosion resistance, thermal conductivity, and hardness.

Fortify Low Shrink Aluminum Silicate (LS-AS) is a mid-grade ceramic for general industry use. This ceramic exhibits a remarkably low 5% shrink upon sintering to deliver high tolerance for both large and small parts that feature high geometric complexity.

MATERIAL PROPERTIES

PHYSICAL PROPERTY	LOW SHRINK ALUMINUM SILICATE
Chemical Purity (%)	-
Sintered Density (g/cc)	2.46
Shrinkage (%)	5
Operating Temperature (°C)	1450
Largest Part Dimension (mm)	10

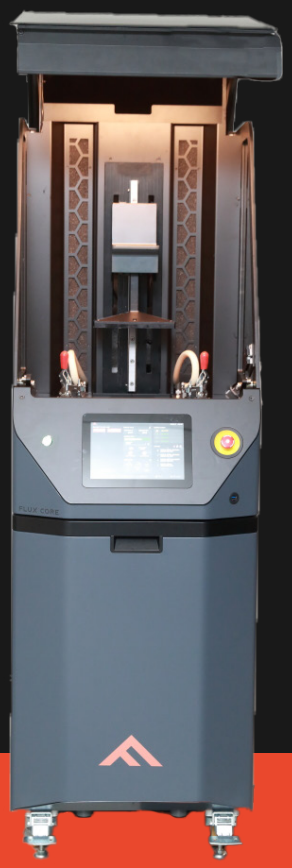
PHYSICAL PROPERTY	HIGH PURITY ALUMINA (99.8%)
Chemical Purity (%)	99.8
Sintered Density (g/cc)	3.61
Shrinkage (%)	12
Operating Temperature (°C)	1750
Largest Part Dimension (mm)	5

Fortify's FLUX CORE printer can quickly process ceramic-filled photoresins in its 526 in^3 build volume. FLUX CORE is a DLP style printing platform designed to produce fine-featured parts from heavily loaded materials that other printers simply cannot process. Fortify's FLUX CORE incorporates our proprietary Continuous Kinetic Mixing (CKM™) module that circulates, heats, and mixes loaded materials to maintain ceramic particle suspension and dispersion throughout the printing process.

SAMPLE APPLICATIONS

Fortify is extending the application space for 3D printed technical ceramics, across industries such as:

- **Aerospace and Aviation – Bearings, seals, and thermal shields.**
- **Medical – Surgical implants, tools and guides.**
- **Chemical production: Components that will survive rapid temperature changes, pressure, and corrosion.**
- **Electronics – Waveguides, sensors, heat sinks and more.**



FLUX DEVELOPER SOFTWARE

To expand your palette of materials even further, Fortify's Flux Developer Software gives users full access to tune printing parameters for custom material development applications. These are the same powerful tools that Fortify's material science team uses daily to generate new materials. Fortify can also take on custom material development projects for you.