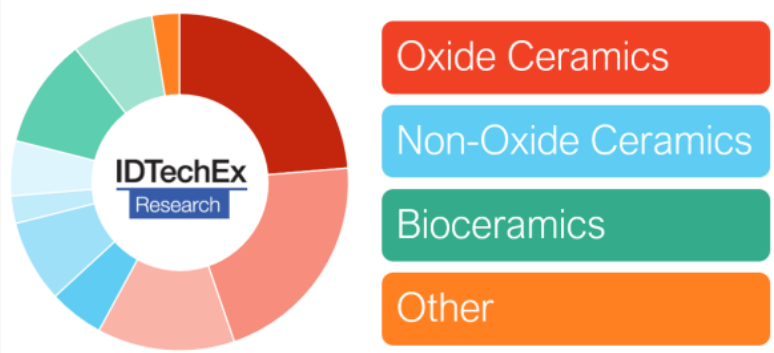
IDTechEx Examines the Ceramic 3D Printing Materials on the Market

CAMBRIDGE, UNITED KINGDOM, November 3, 2021 /EINPresswire.com/ -- Recently, ceramic 3D printer and material manufacturer Tethon 3D announced a partnership with composite 3D printing start-up Fortify to develop more technical ceramic materials for 3D printing. By increasing the portfolio of advanced ceramics available for 3D printing, the two companies aim to advance the adoption of ceramic 3D printing in technical applications.



Technical ceramic types available in the ceramic additive manufacturing market. Source: IDTechEx.

"Expanding our platform to the technical ceramics market is a natural evolution for Fortify," Joshua Martin, CEO and Co-Founder of Fortify said. "Pushing the envelope with these materials requires processing of highly-loaded, abrasive, and viscous materials. These are the same capabilities that drive our success across various technical photopolymers."

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>
> *Joshua Martin, CEO and Co-Founder of Fortify*

Increasing the number of ceramics available for 3D printing will certainly open the door for ceramic additive manufacturing to penetrate into high-performance applications in demanding sectors like aerospace, medicine, and energy. That begs the question: what ceramic materials are currently being 3D-printed, and what forms do they take?

Types of Ceramics Being 3D-Printed

One of the first ceramic materials to be 3D printed was clay. Numerous manufacturers of clay extrusion printers, like Delta, WASP, and CERAMBOT, have entered the ceramic 3D printing market over the years, primarily targeting the art, architecture, and design sectors. One prominent 3D Printing design studio, San Francisco-based Emerging Objects, famously prints

clay and porcelain into towering innovative sculptures and buildings. That said, ceramic additive manufacturing has largely moved away from whitewares, like clay and porcelain, towards technical ceramics. Technical ceramics offer the opportunity to utilize 3D printing for producing high-performing parts for high revenue-generating industries, like aerospace & defense, the chemical industry, and dentistry.

Oxide Ceramics: The main type of ceramic being printed are oxide ceramics, like alumina and zirconia. These binary oxides are typically cheaper and easier to process than many non-oxide ceramics, helping to increase their popularity in 3D printing. Outside of 3D printing, alumina is commonly used in medical implants and devices, while zirconia is increasing its penetration into the dental industry as it's used for dental implants and veneers. Both dentistry and medicine are target sectors for the 3D printing industry as a whole, as they present opportunities for mass customization that 3D printing is built to support. Given these facts, it's thus unsurprising that alumina and zirconia are some of the most popular ceramic 3D printing materials currently available. Nearly every major ceramic 3D printer manufacturer, like Lithoz, Admatec, and 3D Ceram, develop and sell zirconia and alumina for ceramic 3D printing.

Non-oxide Ceramics: Non-oxide ceramics, such as silicon carbide and aluminum nitride, are less common within the market than oxide ceramics. This can be attributed to two main factors: the increased cost and increased difficulty in printing non-oxide ceramics. That said, non-oxide ceramics are becoming more available commercially within the ceramic additive manufacturing market, as non-oxide ceramics are particularly useful in extreme environments given their high heat and corrosion resistance. Recently, more companies have debuted their own non-oxide ceramics for 3D printing. This includes not only ceramic 3D printing manufacturers like Lithoz, Admatec, and 3D Ceram but also ceramic materials suppliers like SGL Carbon and Schunk Carbon Technology. Ceramic materials suppliers tend not to produce 3D-printable ceramics for direct purchase; instead, they offer these materials as part of in-house part production services.

Bioceramics: Bioceramics broadly refer to ceramics used within the body that stimulate cell activity. Bioceramics have been the subject of extensive academic research within the past decade because they offer the opportunity to create implantable devices that are not only non-toxic but also actively help the body repair itself. The ability to 3D print bioceramic implants interests many in the medical device and academic research fields because 3D printing facilitates the creation of implants customized to fit individual patients' bodies. The two most bioceramics explored within ceramic 3D printing are hydroxyapatite (HA) and tri-calcium phosphate (TCP); these bioceramics are popular not only for their material properties but their prevalence within medicine, as numerous HA and TCP implants and devices (not-3D printed) have been previously approved by the United States Food and Drug Administration (FDA).

Feedstock Forms of Ceramic 3D Printing Materials

Having identified the most common ceramic materials found in the 3D printing market, in what

feedstock forms might one find these ceramics? Overall, there are six main feedstock types for ceramics, four of which involve polymers as intermediary binders and two of which do not:

- Photopolymer resins: where ceramic powder is incorporated into resins to make a slurry for printing
- Thermoplastic filaments: where ceramic powder is mixed with thermoplastic to make a filament for extrusion
- Thermoplastic pellets: where ceramic powder is mixed with thermoplastics to make pellets for extrusion
- Ceramic paste: where viscous ceramic paste, like clay or porcelain, is made for printing
- Ceramic powder: where micron-sized ceramic powder particles are used for powder-bed based printing
- Nanoparticle suspensions: where nanoparticles of ceramics are suspended in water for nanoparticle jetting, a type of material jetting

Moving forward: ceramic 3D printing materials

Overall, the materials available for ceramic additive manufacturing are diverse but ripe for further innovation and offerings. Making higher-performing ceramics and ceramic-matrix composites available to 3D printing will broaden ceramic additive manufacturing's ability to become the go-to manufacturing technique for low-volume part production. IDTechEx predicts that the next 10 years will see continued innovation from a materials standpoint, as more materials suppliers and ceramic 3D printing startups enter the market with their own offerings.

For more detailed ceramic 3D printing technology breakdowns and other information on this industry including player profiles, market forecasts, application case studies, and benchmarking studies see "3D Printing Ceramics 2022-2032: Technology and Market Outlook".

For more information on this report, please visit www.IDTechEx.com/3DCeramic, or for the full portfolio of 3D research available from IDTechEx please visit www.IDTechEx.com/Research/3D.

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