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Low shrinkage sintering of additively manufactured transparent silica glass

Silica glass is a versatile material prized for its transparency, chemical and thermal resistance. While it has been traditionally manufactured via glass blowing and the float glass method, recent advances in additive manufacturing (AM) for glass are enabling previously unattainable design freedom. One of the most widely used AM methods is based on powder processing, where a photoresin laden with fumed silica is structured via stereolithography, debound and sintered to produce transparent silica glass components. However, the rheological requirements that stereolithography imposes on these resins typically limit solid loading to moderate levels, inducing a linear shrinkage of approximately 25–30%. While the shrinkage inherent to this process can offer benefits such as sub-pixel resolution, it also necessitates careful heat treatment protocols to prevent cracking.

Here, we demonstrate a novel bimodal stereolithography photoresin formulation and corresponding post-treatment protocol that restricts linear shrinkage to less than 10 %. By minimizing dimensional change during heat treatment, this approach reduces the tendency for crack formation and facilitates the manufacturing of complex geometries with difficult-to-sinter features, such as abrupt cross-sectional variations and sharp internal angles. This opens the pathway to efficient and robust near-net-shape processing of silica glass components.

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

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Author: LANKHOF, Christopher (Delft University of Technology)

Co-authors: Prof. DRANSFELD, Clemens (Delft University of Technology); Prof. MASANIA, Kunal (Delft University of Technology)

Presenter: LANKHOF, Christopher (Delft University of Technology)

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