LITHOGRAPHY-BASED ADDITIVE MANUFACTURING OF ALUMINA

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Structural ceramics as silicon nitride, silicon carbide, zirconia, boron carbide, and alumina have favorable properties like high hardness, wear resistance, high-temperature mechanical strength, creep resistance, corrosion resistance, and chemical inertness making them applicable as cutting tools, wear components, heat exchangers and engine parts [1].

As alumina is bioinert, it is also frequently used as bioceramic material [1]. Having excellent corrosion resistance compared to metallic alloys, alumina is frequently used for total hip prostheses and is considered a promising material for dental implants [2]. One approach to treat patients with the need for prosthesis is using personalized implants. Using additive manufacturing it is possible to fabricate individual and geometrically complex parts directly from a CAD model, which is not processable with conventional manufacturing methods.

Within this work, advancements of printing alumina parts using lithography-based ceramic manufacturing (LCM) are shown. Processing alumina parts by LCM is a two step process. First, a green body is formed via polymerization of monomers by the energy of light. Second, to gain a dense ceramic object, the organic polymer matrix is evaporated and decomposed during debinding and sintering.

The feasibility of realizing dense objects by recycling ceramic scrap and supports is presented. Furthermore, objects printed with slurries containing monomers, plasticizers and additives filled with recycled alumina are compared to parts printed with organic binder filled with virgin alumina powder. It was possible to print, debind and sinter defect free alumina bodies with a wall thickness >10 mm (green body) and 10 mm (after sintering) [3].

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[2] Huang, J., Li, X., & Guo, Z. X. (2020). Biomechanical and biochemical compatibility in innovative biomaterials. In *Biocompatibility and Performance of Medical Devices* (pp. 23-46). Woodhead Publishing.

[3] Schwentenwein, M. (2017). *Provide characterization of sintered ceramic and cermet parts*. Retrieved from http://www.tomax-h2020.eu/media/