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The use of 3D printing and gelation casting to fabricate complex ceramic parts

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The question to be answered by this research is, can a complex shaped ceramic part be manufactured successfully by combining 3D (additive manufacturing) and gelation casting techniques? A 3D printed mold was produced using ABS (Acrylonitrile Butadiene Styrene) filament which formed the negative of the part to be cast. Different gelation systems were used and the solids loading of the alumina ceramic powder in the gel were varied to optimize the systems viscosity. The alumina mixed with the gelation system was cast into the ABS printed molds. The parts were removed by dissolving the ABS mold in acetone. The combination of solids loading and gelation system had a significant influence on the sintered porosity and density of the final parts. An impeller shape was cast in this manner and achieved a density of 99% with an associated hardness of 18GPa. From the successful combining of 3D printing and gelation of alumina ceramic prior to sintering, components were manufactured with properties similar to alumina parts produced by classical processing methods.

Biography

D J Whitefield has worked in the manufacturing sector for the mining industry for 16 years. He was the Technical Manager responsible for plant and process improvement for BOART Longyear. He ran production for five years for BARAT Carbide optimizing process and streamlining the flow of materials through the plant in order to meet and improve quality standards and customer requirements. He was a Section Head at De Beers Research Laboratories responsible for research development of carbide diamond PCD drill bits for oil and gas drilling. Currently, he is a Senior Lecturer at The University of the Witwatersrand focusing on research in ceramics, 3D printing, tape casting, bio ceramics and tungsten carbide projects.

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