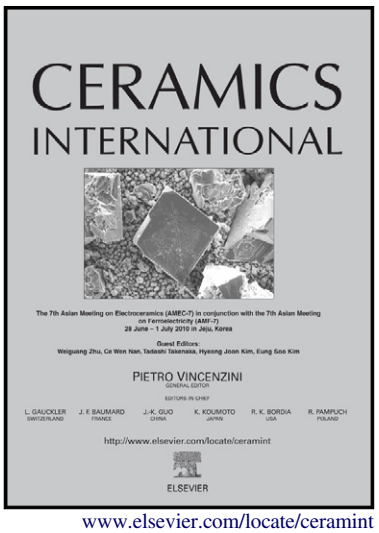

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Effect of layer printing delay on mechanical properties and dimensional accuracy of 3D printed porous prototypes in bone tissue engineering

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Abstract

Recent advancements in computational design and additive manufacturing have enabled the fabrication of 3D prototypes with controlled architecture resembling the natural bone. Powder-based three-dimensional printing (3DP) is a versatile method for production of synthetic scaffolds using sequential layering process. The quality of 3D printed products by this method is controlled by the optimal build parameters. In this study, Calcium Sulphate based powders were used for porous scaffolds fabrication. The X- direction printed scaffolds with a pore size of 0.8 mm and a layer thickness of 0.1125 mm were subjected to the depowdering step. The effects of four layer printing delays of 50, 100, 300 and 500 ms on the physical and mechanical properties of printed scaffolds were investigated. The compressive strength, toughness and tangent modulus of samples printed with a delay of 300 ms were observed to be higher than other samples. Furthermore, the results of SEM and μCT analyses showed that samples printed with a delay of 300 ms have higher dimensional accuracy and are significantly closer to CAD software based designs with predefined 0.8 mm macro pore and 0.6 mm strut size.

Keywords

Additive Manufacturing, 3D printing, Dimensional accuracy, Compressive strength, Delay in Printing.