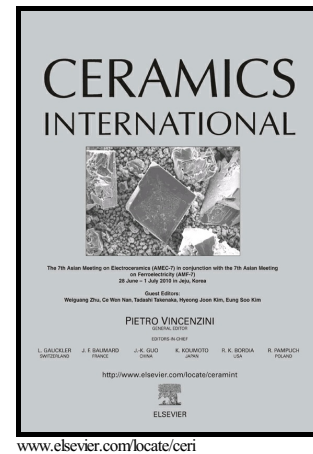


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Study on surface quality, precision and mechanical properties of 3D printed**ZrO₂ ceramic components by laser scanning stereolithography**

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Abstract: Zirconia (ZrO₂) ceramic bars with three different printing sizes were fabricated by a stereolithographic (SLA) 3D-printing process and subsequent sintering. An anisotropic character of the ceramics surface quality was observed. The surface roughness of the horizontal surface was below 0.41 μm , whereas it reached 1.07 μm along the fabrication direction on the vertical surface. The warpage and flatness were utilized to measure the dimensional accuracy of the 3D printed ZrO₂. Furthermore, it was evaluated that the warpage and flatness were below 40 μm and 27 μm , respectively, even if the printed size of ceramic bar reached 3mm×4mm×80mm. In addition, the flexural strength, the fracture toughness, the hardness and the density of ZrO₂ ceramics can reach to $1154 \pm 182 \text{ MPa}$, $6.37 \pm 0.25 \text{ MPa}\cdot\text{m}^{1/2}$, $13.90 \pm 0.62 \text{ GPa}$ and up to 99.3%, respectively. Moreover, the effects of scanning paths and printing size on properties of the sintered ZrO₂ samples were analyzed. The anisotropic character of surface quality was related to the various scanning paths. The warpage and flatness of 3D printed ZrO₂ bars were apparently affected by the various printed sizes. Also, the effects of special microstructure on the mechanical properties of sintered ZrO₂ samples were investigated.

Keywords: 3D printing, ZrO₂ ceramic, Surface quality, Precision, Mechanical properties

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