Effect of Fe$_2$O$_3$ on the densification behaviour and mechanical properties of zirconia-toughened alumina (ZTA)
composites prepared by two-stage sintering

AIP Conference Proceedings 2233, 020029 (2020); https://doi.org/10.1063/5.0001622

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ABSTRACT

The effect of Iron Oxide (Fe₂O₃) addition from 0 to 0.8 vol% on Zirconia Toughened Alumina (ZTA) with 10 vol% Yttria-Tetragonal Zirconia Polycrystals (Y-TZP) produced through conventional pressureless two-stage sintering (TSS) were investigated. The ZTA samples were sintered with first stage sintering temperature T₁ ranging from 1400°C and 1550°C with a heating rate of 20°C/min followed by second stage sintering temperature T₂ of 1350°C and hold for 12 hours. The ZTA samples’ were then evaluated on its’ microstructure and mechanical properties such as grain size, bulk density, Vickers hardness, Young’s modulus and fracture toughness. Compared to undoped ZTA composites, addition of Fe₂O₃ were beneficial in enhancing the composites’ bulk density, Vickers hardness and restricting
grain growth. Addition of 0.4 vol% Fe₂O₃ content and sintered at T of 1450°C was able to achieve 99% Theoretical Density (T.D.), Vickers hardness >18 GPa and Young’s modulus >400 GPa.

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