The effects of CeO2 addition on the physical and microstructural properties of ZTA-TiO2 ceramics composite

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Abstract

The effect of CeO2 addition ranging from 0 wt. % to 7 wt. % on phase, microstructural evolution, physical and mechanical properties of ZTA-3 wt. % TiO2 ceramic composite were investigated. The samples were prepared by solid-state mixing and sintered at 1600 degrees C for 1hr under pressureless condition. Samples were then characterized by XRD, SEM, densitometer and Vickers indentation method. Based on XRD analysis, m-ZrO2 began to diminish at 1 wt.% CeO2 while secondary phases, i.e. Ce0.7Zr0.3O2 and Zr0.4Ti0. 6O2 initiated at 3 wt.% CeO2 addition. SEM images showed finer grain sizes was produced upon increasing amount of CeO2 up to 5 wt.%, corresponding to higher average grain intercept (AGI) values. From the results obtained, the optimum amount of CeO2 addition was at 5 wt. % which yielded the highest bulk density (4.41 g/cm(3)), firing shrinkage (21.94%), hardness (1580.10HV) and fracture toughness (9.77 MPa m(1/2)). This is contributed by the grain refinement and the highest amount of secondary phases formed, especially Zr0.4Ti0.6O2. However, with an excessive addition of CeO2, i.e more than 5 wt.%, grain sizes enlarged and the amount of secondary phases reduced, which degraded the mechanical properties of ZTA-3 wt. % TiO2. (C) 2018 Elsevier B.V. All rights reserved.

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