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Effects of MgO addition on the phase, mechanical properties, and microstructure of zirconia-toughened alumina added with CeO_2 ($ZTA-CeO_2$) ceramic composite (Article)

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Abstract

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The effects of MgO addition on properties such as density, firing shrinkage, microstructure, Vickers hardness, and fracture toughness of $ZTA-CeO_2$ ceramics composites were investigated. The amount of CeO_2 used in the experiment was fixed at 5.0wt% while the MgO addition was varied from 0wt% to 2.0wt%. Each composition was weighed, mixed, and pressed using hydraulic press under 300MPa into 13mm pellets. The pellets were sintered at 1600°C for 4h under pressureless condition. Vickers hardness and fracture toughness of the sintered samples were measured using the Vickers indentation method. Based on the SEM microstructures, elongated secondary phase, i.e. $MgAl_{11}CeO_{19}$, started to occur at 0.5wt% MgO. This elongated phase was responsible for the increase in fracture toughness of the ceramic composites. Similarly, the addition of more than 0.5wt% MgO produced another secondary phase ($MgAl_2O_4$), as detected by XRD. This phase was shown to have low intrinsic fracture toughness. Therefore, the sample with 0.5wt% MgO showed the optimum properties with the highest fracture toughness (9.14MPam) and Vickers hardness (1591HV) values. © 2013 Elsevier B.V.

Author keywords

Fracture toughness | MgO | Microstructure | Vickers hardness

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