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Effects of MgO addition on the phase, mechanical properties, and microstructure of zirconia-toughened alumina added with CeO₂ (ZTA-CeO₂) 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-CeO₂ ceramics composites were investigated. The amount of CeO₂ 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. MgAl₁₁CeO₉, 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 (MgAl₂O₄), 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

Indexed keywords

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Microstructure Pelletizing Sintering Vickers hardness Zirconia

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