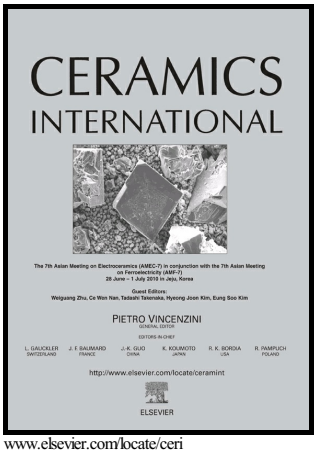

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Influence of solid loading on the rheological, porosity distribution, optical and the microstructural properties of YAG transparent ceramic

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Abstract

Stable aqueous dispersed mixture of commercial Al_2O_3 and Y_2O_3 nano powders was prepared by ball mill. Ammonium poly meta acrylate (Dolapix CE64) and tetraethyl orthosilicate (TEOS) were added as dispersant and sintering aid, respectively. The effects of slurry solid loading on the fabrication of transparent polycrystalline YAG ceramics by slip casting method were investigated. The rheological properties of slurries with different solid loading (64, 70 and 76 wt%) were studied by measuring the viscosity and shear stress as a function of shear rate. The effect of solid loadings on the porosity distribution was examined. The specimens were vacuum-sintered at 1715 ˚C for 10 h. Slips with 64 and 70 wt% solid loading behaved as near-Newtonian and as non-Newtonian with thixotropic behavior at 76 wt% solid loading. The relative densities of the green bodies increased from 58.0±0.6% (SD=0.424) to 64.0±0.3% (SD=0.228) by increasing the solid loading from 64 wt% to 70 wt% and then decreased to 63.0±0.2% (SD=0.141) at 76 wt% solid loading. The results showed that the suitable solid loading for fabricating transparent YAG ceramics is 70 wt%. This sample had the narrowest pore size distribution (4-100 nm), homogenized surface fracture of green body, dense microstructure (99.990±0.005% final relative density, SD=0.003) and the average grain size of 6 μm. It had the highest in-line transmittance, which was approximately 77% at 1064 nm.

Keywords: YAG, Polycrystalline, Slip casting, Solid loading, Transparent ceramic