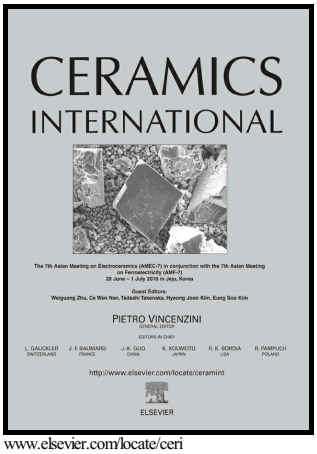

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Porous fibrous ZrO_2-mullite ceramics prepared via tert-butyl alcohol-based gel-casting

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Abstract

Mullite fiber was used to fabricate ZrO_2-mullite based porous ceramic via tert-butyl alcohol (TBA)-based gel-casting process using zirconite and bauxite as raw materials. Phase compositions, microstructure, pore size distribution, linear shrinkage, bulk density, apparent porosity, thermal conductivity, and compressive strength were analyzed to investigate influences of mullite fiber content and added Y_2O_3 on prepared porous ceramics. Results show that bird nest-like three-dimensional fibrous reticular skeleton structure was constructed with mullite fibers that evenly enwrapped rod-like mullite and ZrO_2 grains. Prepared porous fibrous ZrO_2-mullite ceramics had narrow pore size distribution that consisted of mullite and m-ZrO_2. With an increase in mullite fiber content, linear shrinkage and bulk density decreased, apparent porosity increased, and relatively good thermal conductivity was obtained. In addition, added Y_2O_3 reacted with Al_2O_3 and SiO_2 to form Y-Al-Si-O glass phase, which promoted sintering and densification of the ceramic, thus improving its compressive strength.

Keywords: Mullite fiber; ZrO_2; Porous ceramic; Gel-casting process; Y_2O_3 additive

1. Introduction

Porous ceramics with high area ratio and good heat insulation have been widely used for filtration and catalysis in chemical industry, metallurgy, pharmaceuticals, aeronautics, and astronautics. Many methods, such as organic foam impregnation, foaming, pore-forming agents and freeze-drying, have been used to prepare porous ceramics with different pore parameters. For example, the pore size of porous