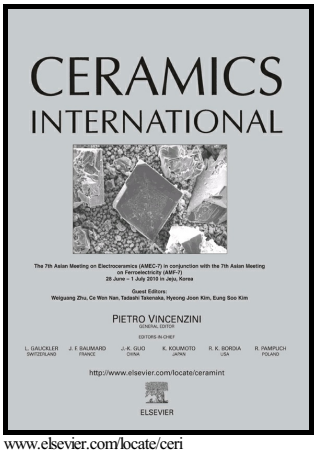

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Mechanical Strength and Damage Tolerance of Highly Porous Alumina Ceramics Produced from Sintered Particle Stabilized Foams

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Abstract

Highly porous alumina particle stabilized foams were prepared by combining the concepts of particle stabilized foams and gelcasting, using sulfonate surfactants and poly vinyl alcohol (PVA) as the gelcasting polymer. The ceramic samples sintered at 1500°C for 2h had porosities from 65 to 93%, with pore sizes in two categories: "*big pore*" around 300 μm and "*small pore*", around 100-150 μm, depending on the type and amount of surfactant added. The mechanical behaviour of the foams (axial and diametral compression) depended on the overall porosity and pore size. On average, tensile and compressive strengths around 5 and 16 MPa respectively were measured for samples with bigger pore sizes and larger porosities. Samples with smaller pore sizes and lower porosities produced average values of 12 and 57MPa for tensile and compressive strengths, respectively. The elastic modulus reached a maximum around 3GPa for "*small pore*" size samples. The effect of increasing amount of PVA in the samples had a strong effect on the green mechanical strength, but it did not significantly affect the mechanical response of the sintered alumina foams. Large and complex shape sintered components produced using this route showed a remarkable damage tolerance, due to crack tip blunting.

Keywords: Porous Ceramics, Particle Stabilized Foams, Gelcasting, Porosity, Pore size, PVA, Mechanical Strength, Damage Tolerant.

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