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Impedance spectroscopy analysis of flash sintered zirconia: 8 mol% yttria solid electrolytes with alkali halide addition

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Electrical properties of porous ZrO_2:8 mol% Y_2O_3 ceramics with LiF sintering aid were studied. The specimens were sintered by transient liquid phase formation under the application at 650°C of 200 V cm^{-1} AC electric field for various current density, current elapsed time, and lithium fluoride content. Low electric current densities coupled with long application times produced homogeneous specimens. Variations in the electric current density and current elapsed time allowed to obtain sample densification in the 60%-75% range. Impedance spectroscopy measurements were carried out to estimate the relative pore content, evaluating the product of the blocking factor α_R ($=R_g/(R_g + R_{gb})$, R, g and gb stand for resistance, grain and grain boundary, respectively) to the frequency factor α_f ($= f_{gb}/f_g$, f is the characteristic frequency), which is proportional to the blocker volume, i.e., the porosity. A direct correspondence between $\alpha_R \bullet \alpha_f$ and the apparent porosity, obtained after determining the apparent density by the Archimedes method, was observed.