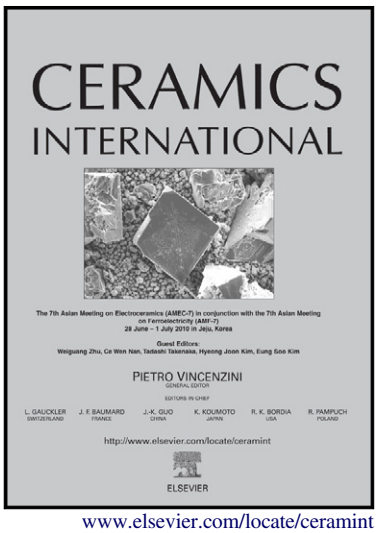

Crystallization behavior and properties of K_2O-CaO-Al_2O_3-SiO_2 glass-ceramics

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Abstract

In order to obtain high-strength anorthite glass-ceramics, K_2O-CaO-Al_2O_3-SiO_2 quaternary glass and relevant glass-ceramics were prepared and investigated. The results show that anorthite along with kalsilite or leucite was precipitated from the parent glass. Kalsilite crystals were formed firstly and then converted into leucite through reacting with SiO_2 in the glass phase. The morphology of the crystals was dependent on the heat-treatment temperature. Column crystals were transformed into fine granular grains when the sintering temperature changed from 900 to 1100 °C. The activation energy (E_α) and avrami constant (n) were also calculated as 463.81 KJ/mol and 3.74, indicating that bulk nucleation and three-dimensional crystal growth were the dominating mechanisms in the temperature range 1000 ~ 1100 °C. The maximum value of the flexural strength for the glass-ceramics containing leucite was 248 MPa and the coefficient of thermal expansion (CTE) was in the range 5.69 ~ 11.94 $\times 10^{-6}\,K^{-1}$. The leucite is the main reason for the high CTEs and high flexural strength of glass-ceramics.

Keywords: glass-ceramic; anorthite; crystallization behavior; thermal expansion; flexural strength

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