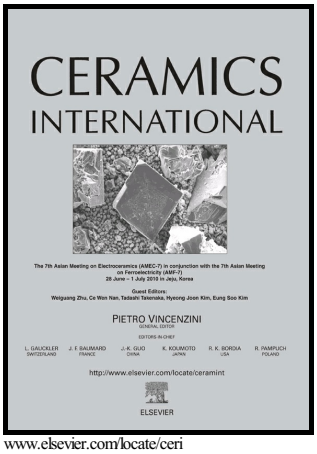

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Temperature Stable and High-Q Microwave Dielectric Ceramics in the $Li_2Mg_{3-x}Ca_xTiO_6$ system (x=0.00~0.18)

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Abstract

Microwave dielectric properties of $Li_2Mg_{3-x}Ca_xTiO_6$ (x=0~0.18) ceramics were studied using a conventional solid-state route to find temperature stable and high Q microwave ceramics. As the calcination temperature was 500 °C, the Li_2TiO_3 phase with monoclinic rock salt structure in C2/c space group started to form. When the samples were calcined from 600 °C to 900 °C, the XRD patterns exhibited a remarkable chemical reaction between the MgO and Li_2TiO_3 phases, which eventually formed the $Li_2Mg_3TiO_6$ phase. The results indicated the $Li_2Mg_3TiO_6$ and $CaTiO_3$ co-existed with each other and formed a stable composite system when the calcium content was added. The SEM photographs indicated that the pores caused by the Li evaporation could be effectively reduced due to the appearance of $CaTiO_3$. As x was increased from 0 to 0.18, the relative density was significantly improved due to the elimination of pores. As the Ca content increased, the dielectric constant (ε_r) increased from 14.8 to 20.6; the quality factor (Q×f) decreased from 148,713 GHz to 79,845 GHz, and the temperature coefficient of resonant frequency (τ_f) significantly increased from −42.4 to +10.8 ppm/°C due to the increased amount of $CaTiO_3$. Therefore, at x=0.12, the LMCxT ceramics sintered at 1280 °C for 6 h displayed excellent comprehensive properties of ε_r= 17.8, Q×f= 102,246 GHz and τ_f = -0.7 ppm/°C.

Keywords: Microwave Ceramics; Dielectrics; Temperature Stable; High Q