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 $\text{Li}_2\text{Mg}_{3-x}\text{Ca}_x\text{TiO}_6$ system ($x=0.00\sim 0.18$)

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Temperature Stable and High-Q Microwave Dielectric Ceramics in the

 $\text{Li}_2\text{Mg}_{3-x}\text{Ca}_x\text{TiO}_6$ system ($x=0.00\sim0.18$)Zixuan Fang^{a,b}, Bin Tang^{a,b*}, Feng Si^{a,b}, Shuren Zhang^{a,b}^aNational Engineering Center of Electromagnetic Radiation Control Materials,

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Abstract

Microwave dielectric properties of $\text{Li}_2\text{Mg}_{3-x}\text{Ca}_x\text{TiO}_6$ ($x=0\sim0.18$) 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 $\text{Li}_2\text{Mg}_3\text{TiO}_6$ phase. The results indicated the $\text{Li}_2\text{Mg}_3\text{TiO}_6$ 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 ($Q\times f$) 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 $\epsilon_r=17.8$, $Q\times f=102,246$ GHz and $\tau_f=-0.7$ ppm/°C.

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

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