中文摘要

本論文將探討 MgO 與 Mg(OH)2 對無煆燒法製備 MgTiO3 基微波介電陶瓷之影響，在實驗中我們將粉末混合、球磨後，不經煆燒步驟直接壓模成型，進行燒結。以 MgO 為原料時，MgTiO3 (MT)、0.95MgTiO3-0.05CaTiO3 (95MCT)和0.97MgTiO3-0.03SrTiO3 (97MST)陶瓷中都有 MgTi2O5 二次相生成，使用 Mg(OH)2 取代 MgO 後，經無煆燒法可獲得不含二次相之 MgTiO3+2mol% Mg(OH)2 (MHT2)、0.95MgTiO3-0.05CaTiO3+2mol% Mg(OH)2 (95MHCT2)和 0.97MgTiO3-0.03SrTiO3+2mol% Mg(OH)2 (97MHST2) 陶瓷體。從 SEM 圖中發現，MHT、95MHCT2 和 97MHST2 陶瓷體均有晶粒異常成長的狀態。MT 陶瓷在 1300°C 燒結 2 小時可獲得微波介電特性為：ε =19.2、Q×f=76,300GHz (10.3GHz) 和 τ =-55.2ppm/oC。MHT 陶瓷在 1350°C 燒結 2 小時可獲得微波介電特性為：ε =15.7、Q×f=143,700GHz (11.4GHz) 和 τ =-50.4ppm/oC。95MCT 陶瓷在 1250°C 燒結 6 小時可獲得微波介電特性為：ε =22.6、Q×f=43,000GHz (9.6GHz) 和 τ =0ppm/oC。95MHCT2 陶瓷在 1250°C 燒結 2 小時可獲得微波介電特性為：ε =19.1、Q×f=67,700GHz (10.3GHz) 和 τ =-5ppm/oC。97MST 陶瓷在 1350°C 燒結 2 小時可獲得微波介電特性為：ε =20.8、Q×f=19,400GHz (10GHz) 和 τ =1.2ppm/oC。97MHST2 陶瓷在 1250°C 燒結 2 小時可獲得微波介電特性為：ε =17.4、Q×f=32,200GHz (10.7GHz) 和 τ =0.9ppm/oC。
Effects of MgO and Mg(OH)2 on MgTiO3-based microwave dielectric ceramics via a non-calcining process were investigated. Without any calcinations involved, the mixture of raw materials were pressed and sintered directly. MgTi2O5 phase was detected in MgTiO3 (MT), 0.95MgTiO3-0.05CaTiO3 (95MCT) and 0.97MgTiO3-0.03SrTiO3 (97MST) ceramics using MgO. There are no secondary phases in MgTiO3+2mol% Mg(OH)2 (MHT2), 0.95MgTiO3-0.05CaTiO3+2mol% Mg(OH)2 (95MHCT2) and 0.97MgTiO3-0.03SrTiO3+2mol% Mg(OH)2 (97MHST2) ceramics when the Mg(OH)2 is used. Abnormal grains were observed in MHT, 95MHCT2 and 97MHST2 ceramics. The microwave dielectric properties: \( \varepsilon_r=19.2 \), \( Q\times f=76,300\text{GHz (10.3GHz)} \) and \( \tau_f=55.2\text{ppm/oC} \) were obtained in MT ceramics sintered at 1300oC for 2 h. \( \varepsilon_r=15.7 \), \( Q\times f=143,700\text{GHz (11.4GHz)} \) and \( \tau_f=50.4\text{ppm/oC} \) were obtained in MHT2 ceramics sintered at 1350oC for 2 h. The microwave dielectric properties: \( \varepsilon_r=22.6 \), \( Q\times f=43,000\text{GHz (9.6GHz)} \) and \( \tau_f=0\text{ppm/oC} \) were obtained in 95MCT ceramics sintered at 1250oC for 6 h. \( \varepsilon_r=19.1 \), \( Q\times f=67,700\text{GHz (10.3GHz)} \) and \( \tau_f=5\text{ppm/oC} \) were obtained in 95MHCT2 ceramics sintered at 1250oC for 2 h. The microwave dielectric properties: \( \varepsilon_r=20.8 \), \( Q\times f=19,400\text{GHz (10GHz)} \) and \( \tau_f=1.2\text{ppm/oC} \) were obtained in 97MST ceramics sintered at 1350oC for 2 h. \( \varepsilon_r=17.4 \), \( Q\times f=32,200\text{GHz (10.7GHz)} \) and \( \tau_f=0.9\text{ppm/oC} \) were obtained in 97MHST2 ceramics sintered at 1250oC for 2 h.