

# 中文摘要

本研究以反應燒結法製備 $(1-x)\text{ZnNb}_2\text{O}_6-x\text{TiO}_2$  與  $\text{NiNb}_2\text{O}_6-y\text{TiO}_2$  微波介電陶瓷。 $x=0.5$ ， $y=1$  時直接燒結混合原料即可以獲得單一相的  $\text{Zn}_{0.5}\text{Ti}_{0.5}\text{NbO}_4$ (ZTN)與  $\text{Ni}_{0.5}\text{Ti}_{0.5}\text{NbO}_4$ (NTN)陶瓷，且密度皆可達理論密度之 99%以上。ZTN 燒結在  $1200^\circ\text{C}$  持溫 2 小時有較佳微波介電特性： $Q_{xf}=35000\text{GHz}$ ， $\epsilon_r=32.6$  和  $\tau_f=-48.38\text{ ppm}/^\circ\text{C}$ 。NTN 燒結在  $1170^\circ\text{C}$  持溫 6 小時有較佳微波介電特性： $Q_{xf}=3568\text{GHz}$ ， $\epsilon_r=53.8$  和  $\tau_f=+103.68\text{ ppm}/^\circ\text{C}$ 。在  $\text{ZnNb}_2\text{O}_6$  與  $\text{NiNb}_2\text{O}_6$  陶瓷中分別加入適當量之  $\text{TiO}_2$  可使  $\tau_f$  值接近  $0\text{ ppm}/^\circ\text{C}$ ， $x=0.6$  時可得較佳微波介電特性： $Q_{xf}=19000\text{GHz}$ ， $\epsilon_r=49.9$  和  $\tau_f=0\text{ ppm}/^\circ\text{C}$ ， $y=0.1$  時可得  $Q_{xf}=18700\text{GHz}$ ， $\epsilon_r=29.3$  和  $\tau_f=-0.05\text{ ppm}/^\circ\text{C}$ 。添加 0.5wt%CuO 於 ZTN 與 NTN 可以成平飢 C 燒結溫度，分別於在  $1070^\circ\text{C}/4\text{ h}$  與  $1130^\circ\text{C}/4\text{ h}$  可獲得較佳微波介電特性： $Q_{xf}=32000\text{GHz}$ ， $\epsilon_r=31.5$  和  $\tau_f=-40.89\text{ ppm}/^\circ\text{C}$  與  $Q_{xf}=3579\text{GHz}$ ， $\epsilon_r=53.2$  和  $\tau_f=+93.81\text{ ppm}/^\circ\text{C}$ 。

## 英文摘要

(1-x)ZnNb<sub>2</sub>O<sub>6</sub>-xTiO<sub>2</sub> and NiNb<sub>2</sub>O<sub>6</sub>-yTiO<sub>2</sub> ceramics produced using a reaction-sintering process were investigated. Without any calcination involved, pure Zn<sub>0.5</sub>Ti<sub>0.5</sub>NbO<sub>4</sub> (ZTN) and Ni<sub>0.5</sub>Ti<sub>0.5</sub>NbO<sub>4</sub> (NTN) phases could be obtained successfully after sintering the pellets with x=0.5, y=1. Pellets with >99% of theoretical density could be obtained. Microwave dielectric properties Q×f=35000GHz, ε<sub>r</sub>=32.6, and τ<sub>f</sub>=-48.38 ppm/oC in ZTN sintered at 1200oC for 2 h and Q×f=35000GHz, ε<sub>r</sub>=32.6, and τ<sub>f</sub>=-48.38 ppm/oC in NTN sintered at 1170oC for 6 h were found. As TiO<sub>2</sub> was added into ZnNb<sub>2</sub>O<sub>6</sub> and NiNb<sub>2</sub>O<sub>6</sub> τ<sub>f</sub> values approach 0 ppm/oC could be found. Microwave dielectric properties Q×f=19000GHz, ε<sub>r</sub>=49.9, and τ<sub>f</sub>=0 ppm/oC in pellets with x=0.6 and Q×f=18700GHz, ε<sub>r</sub>=29.3, and τ<sub>f</sub>=-0.05 ppm/oC in pellets with y=0.1 were obtained. With CuO addition, the sintering temperature was lowered to 1070oC for ZTN and 1130oC for NTN. The microwave dielectric properties Q×f=32000GHz, ε<sub>r</sub>=31.5 and τ<sub>f</sub>=-40.89 ppm/oC for ZTN were found. Q×f=3579GHz, ε<sub>r</sub>=53.2 and τ<sub>f</sub>=+93.81 ppm/oC for NTN were found.