中文摘要

本研究以反應燒結法製備(1-x)ZnNb2O6-xTiO2 與 NiNb2O6-yTiO2 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 Zn0.5Ti0.5NbO4(ZTN) 與 Ni0.5Ti0.5NbO4(NTN) 陶瓷，且密度皆可達理論密度之 99%以上。ZTN 燒結在 1200℃ 持溫 2 小時有較佳微波介電特性: Qxf=35000GHz，εr=32.6 和 τf=-48.38 ppm/℃。NTN 燒結在 1170℃ 持溫 6 小時有較佳微波介電特性: Qxf=3568GHz，εr=53.8 和 τf=+103.68 ppm/℃。在 ZnNb2O6 與 NiNb2O6 陶瓷中分別加入適當量之 TiO2 可使 τf 值接近 0 ppm/℃。x=0.6 時可得較佳微波介電特性: Qxf=19000GHz，εr=49.9 和 τf=0 ppm/℃，y=0.1 時可得 Qxf=18700GHz，εr=29.3 和 τf=-0.05 ppm/℃。添加 0.5wt%CuO 於 ZTN 與 NTN 可以成平飢 C 燒結溫度，分別於在 1070℃/4h 與 1130℃/4h 可獲得較佳微波介電特性: Qxf=32000GHz，εr=31.5 和 τf=-40.89 ppm/℃ 與 Qxf=3579GHz，εr=53.2 和 τf=+93.81 ppm/℃。
(1-x)ZnNb2O6-xTiO2 and NiNb2O6-yTiO2 ceramics produced using a reaction-sintering process were investigated. Without any calcination involved, pure Zn0.5Ti0.5NbO4 (ZTN) and Ni0.5Ti0.5NbO4 (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 $Q\times f=35000\text{GHz}$, $\varepsilon_r =32.6$, and $\tau_f =-48.38 \text{ ppm/oC}$ in ZTN sintered at 1200°C for 2 h and $Q\times f=35000\text{GHz}$, $\varepsilon_r =32.6$, and $\tau_f =-48.38 \text{ ppm/oC}$ in NTN sintered at 1170°C for 6 h were found. As TiO2 was added into ZnNb2O6 and NiNb2O6 $\tau_f$ values approach 0 ppm/oC could be found. Microwave dielectric properties $Q\times f=19000\text{GHz}$, $\varepsilon_r =49.9$, and $\tau_f =0 \text{ ppm/oC}$ in pellets with x=0.6 and $Q\times f=18700\text{GHz}$, $\varepsilon_r =29.3$, and $\tau_f =-0.05 \text{ ppm/oC}$ in pellets with y=0.1 were obtained. With CuO addition, the sintering temperature was lowered to 1070°C for ZTN and 1130°C for NTN. The microwave dielectric properties $Q\times f=32000\text{GHz}$, $\varepsilon_r =31.5$ and $\tau_f =-40.89 \text{ ppm/oC}$ for ZTN were found. $Q\times f=3579\text{GHz}$, $\varepsilon_r =53.2$ and $\tau_f =+93.81 \text{ ppm/oC}$ for NTN were found.