Microwave Dielectric Properties of Mg4Nb2O9-3.0wt%LiF Ceramics

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Abstract

The Mg4Nb2O9-3.0wt%LiF (MNLF) ceramic has been synthesized by the solid-state reaction method in order to obtain the low-temperature cofired ceramics (LTCC). In the case of 3.0wt%LiF addition, it was shown that the sintering temperature of Mg4Nb2O9 (MN) ceramics was reduced from 1350°to 850 without the detrimental effect on the dielectric constant (r) and quality factor (Qf). However, a near zero temperature coefficient of resonant frequency (f) of MNLF was not obtained in this case. Thus, in order to obtain the f value which closes to 0 ppm/ the effects of CaTiO3 addition on the f of MNLF were investigated in this study. The starting materials were reagent-grade (purity ¿ 99.9 %) MgO and Nb2O5 powders, and then the specimens of MN ceramics were prepared by using a conventional solid-state reaction method. The dopants were LiF and CaTiO3 and combined with the re-calcined powder. The microwave dielectric properties were measured by Hakki and Colemans method. The identification of specimens was performed in terms of X-ray powder diffraction. With increasing the amounts of CaTiO3 additions from 0 to 10wt%, the dielectric constants increased from 12.3 to 18.3, the quality factors drastically decreased from 118989 to 11119 GHz, and the temperature coefficients of resonant frequency increased from -71.5 to 39.3 ppm/. From these results, the MNLF-6.0wt%CaTiO3 sintered at 950 for 10h showed the appropriate dielectric properties: r=15.7, Qf=22098 GHz, and f = -3.3 ppm/.