

### Effects of Sintering additives on the Sintering and Microwave Dielectric Properties of $(Zn_{0.8}Mg_{0.2})TiO_3$ System

Woo-Sung Sim and Jaecheol Bang

Department of Materials Science and Engineering, Soonchunhyang University

The effects of sintering additives such as  $B_2O_3+V_2O_5$  and  $B_2O_3$  on the microwave dielectric and sintering characteristics of  $(Zn_{1-x}Mg_x)TiO_3$  system were investigated. Highly dense samples were obtained for  $(Zn_{0.8}Mg_{0.2})TiO_3$  at the sintering temperature range of 870–910°C with  $B_2O_3+V_2O_5$  and  $B_2O_3$  additions. The microwave dielectric properties of  $(Zn_{0.8}Mg_{0.2})TiO_3$  with 0.45 wt%  $B_2O_3$  and 0.55 wt%  $V_2O_5$  sintered at 900°C were as follows.  $Q \times f_0 = 50,800$  GHz,  $\epsilon_r = 22$ , and  $\tau_f = -53$  ppm/°C. In order to improve temperature coefficient of resonant frequency,  $TiO_2$  was added to the above system. The optimum amount of  $TiO_2$  was 15 mol% when sintered at 870°C, at which we could obtain following results:  $Q \times f_0 = 32,800$  GHz,  $\epsilon_r = 26$ , and  $\tau_f = 0$  ppm/°C. When  $B_2O_3$  is added, temperature coefficient of resonance frequency ( $\tau_f$ ) changes to a positive value with increasing the amount of  $B_2O_3$  because of the increased amount of rutile phase. The  $Q \times f_0$  values of the  $B_2O_3$  added system were determined by the microstructures and sintering shrinkages which in turn are affected by the existing rutile or second phases. When 6.19 mol% of  $B_2O_3$  added and sintered at 910°C for 5 h, it exhibits  $\epsilon_r = 23.7$ ,  $Q \times f_0 = 74,420$  GHz, and  $\tau_f = -1.42$  ppm/°C.

### MgTiO<sub>3</sub> 마이크로파 유전체 세라믹스의 품질계수에 미치는 열변형의 효과

#### Effect of Thermal Strain on the Quality Factor of Microwave MgTiO<sub>3</sub> Ceramics

유선희, \*\*\* 최지원, \*\*\* 윤기현, \* 윤석진 \*\*\*

\*연세대학교 세라믹공학과

\*\*한국과학기술정보연구원(KISTI), 기술혁신사업실

\*\*\*한국과학기술연구원(KIST), 박막재료연구센터

마이크로파 주파수 대역에서  $MgTiO_3$  세라믹스의 품질계수(quality factor)에 미치는 열 변형(thermal strain)의 효과에 대하여 냉각속도를 변수로 하여 고찰하였다. 냉각속도는 각각 1°C/분, 5°C/분, 30°C/분 및 공기 중 급랭으로 변화를 주었다. 냉각속도가 증가함에 따라  $MgTiO_3$  세라믹스의 공진주파수에 따른 온도계수와 유전상수는 변화가 없었다. 그러나 결정학적으로 반치폭(FWHM)에 의해 계산된 변화량은 0.00565에서 0.0101로 냉각속도가 증가함에 따라 증가하였고, 품질계수는 240,000 GHz에서 150,000 GHz으로 감소하였다. 이러한 결과는 품질계수가 열 변형에 영향을 받는 것으로 판단되며, 고유손실(intrinsic loss)과 외부손실(extrinsic loss)과의 관계를 적외선분광(FT-IR) 분석을 통해 고찰하였다.