초청강연 B-1 An Overview of Low Temperature Co-Fired Ceramics

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Rapid progress in the technology and application of LTCC has been clearly driven by the trend of device miniaturization and mobile communication system. This technology provides a high integration density with various passive components. There are several possible LTCC approaches depending on target characteristics and applica- tions. For example, low dielectric loss LTCC has been required for millimeter and military applications. This presentation intends to provide an overview of current LTCC technologies with focus on aspects of materials and processing parameters.

B-2 Low Temperature Sintering of Niobate Ceramics for Microwave Applications

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$BiNbO_4$ and $Zn_3Nb_2O_8$ ceramics with density over 95% was produced at 700°C and 740°C, respectively, by sintering of precursor powders prepared by solution methods. Sinterability of powders demonstrates substantial dependence on the powder synthesis method and thermal processing conditions. Combination of precursor powders with optimum micromorphology and melt-forming sintering aids promotes realization of specific low temperature sintering regime, when the most part of densification occurs during approaching the sintering temperature. The microwave properties of as-obtained ceramics are varied greatly among different compositions, approaching Q*f values >35,000 GHz for $Zn_3Nb_2O_8$.

B-3 Crystal Structure and Microwave Dielectric Properties of $2Li_2O$-B_2O_3 Doped $CaTi_{0.46}(Fe_{0.5}Nb_{0.5})_{0.54}O_3$ Ceramics for LTCC Technology

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An X-ray powder diffraction study of the series $CaTi_{1-x}(Fe_{0.5}Nb_{0.5})_xO_3$ ($0.5 \le x \le 0.6$) solid solution is presented. The crystal structure of the $CaTi_{0.46}(Fe_{0.5}Nb_{0.5})_{0.54}O_3$ ceramics, orthorhombic, space group Pbnm (62), a=5.4194 Å, b=5.5009 Å, c =7.7089 Å, was determined using X-ray powder diffraction. The dielectric properties of ε_r=58.3, Q×f=670 GHz and τ_f=−22 ppm/°C were obtained at 1250°C for 4 h. The addition of $2Li_2O$-B_2O_3 to $CaTi_{0.46}(Fe_{0.5}Nb_{0.5})_{0.54}O_3$ ceramics were synthesized via the conventional solid state reaction and microwave dielectric properties were investigated with sintering behavior at 875~925°C. The sintering temperature of $2Li_2O$-B_2O_3 (3 wt%) additions can be lowered to ~900°C for 2 h, ε_r=54.8, Q×f=8876 GHz and τ_f=−3.6 ppm/°C were achieved and do not react with silver electrode. The $2Li_2O$-B_2O_3 doped $CaTi_{0.46}(Fe_{0.5}Nb_{0.5})_{0.54}O_3$ ceramics are promising candidate as embedded capacitors for LTCC technology.

B-4 계면유도 침전법을 이용한 Mg Coated $BaTiO_3$ Powder 제조

The Preparation of Magnesium Coated $BaTiO_3$ Particles Using Surface-Induced Precipitation Method

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계면유도 침전법을 이용한 magnesium coated $BaTiO_3$ 제작 시 $BaTiO_3$의 particle size가 미치는 영향에 대해 연구하였다. Coating powder의 제조는 $BaTiO_3$와 $MgCl_2 \cdot 6H_2O$를 원료로 사용하여 urea의 분해에 의한 균일 침전법을 이용하였다. $BaTiO_3$의 particle size는 각각 30, 400 nm이며 침전된 $Mg(OH)_2$의 particle size는 10 nm 정도로 700°C 정도의 열처리를 통해 MgO로 결정화가 일어남을 확인하였다. 각 powder의 제타전위는 실험조건인 pH 7.0 부근에서 −18 mV(400 nm $BaTiO_3$), −22 mV(30 nm $BaTiO_3$) 그리고 −2 mV (Mg)로 모두 negative한 값을 보였다. 400 nm의 크기를 갖는 $BaTiO_3$의 경우 Mg coating layer가 관찰되었으나 30 nm 크기의 $BaTiO_3$에는 coating layer가 관찰되지 않았다. Total interaction potential energy 계산 결과 400 nm 크기의 $BaTiO_3$와 Mg particle 간의 결합이 가장 큰 attraction energy 값을 가짐을 확인하였다.