P-117

Low Loss Dielectrics Based on Rare Earth-Modified Zinc Borates

조연화, 연득호, Viswanathan S. Saji, 조용수†
연세대학교 신소재공학과
(ycho@yonsei.ac.kr†)

Low loss dielectric properties of zinc borate glasses modified with rare earth oxides (La_2O_3, Nd_2O_3, Sm_2O_3 and Gd_2O_3) were investigated for the purpose of developing a new low temperature co-fireable system. The lanthanum borate-based LTCC has been reported to provide unusual high quality factors after firing at 850oC. Several different batches of glass consisting of 60 mol% B_2O_3, 20 mol% ZnO, and 20 mol% rare earth oxide, i.e., La_2O_3, Nd_2O_3, Sm_2O_3 and Gd_2O_3 were successfully prepared via the typical glass melting / quenching procedure. A fixed amount of 50 wt% Al_2O_3 filler was then admixed with the glass to produce final samples. As a specific example of optimized dielectric characteristics, a high quality factor of ~1,090 and a dielectric constant of 8.3 were obtained at ~ 17 GHz for the lanthanum zinc borate materials. Understanding the influence of rare earths on microwave dielectric properties and crystallization behavior of zinc borate dielectrics is the main purpose of this presentation.

Keywords: low loss, microwave dielectric,

P-118

Compatibility and Physical Properties of Protective Thick Films for Planar Heating Elements

이형섭, 김병곤, 최홍락, 정철원*, 한동빈*, 조용수†
연세대학교 신소재공학과; *(주) 위너테크
(ycho@yonsei.ac.kr†)

Planar heating elements have been spotlighted since their 20~40% lower power consumption is possible compared to conventional linear heating elements. High thermal conductivity of the planar package, which is required for effective operation of the heating elements, has been one of the critical properties since it lessens the power consumption of heating element. Recently, several materials, which are non-metals, i.e., SiC, MoSi2, LaCrO3, C, and ZrO2, were reported as candidates for heating elements. In this work, the compositions and properties of thick film over-coating layers deposited on 96% Al2O3 substrate, which is needed to protect or buffer the MoSi2-based heating element from thermal shock, have been investigated over the testing temperatures of 500 to 800℃ by focusing on mechanical and thermal stability. For the thick films, borosilicate glass was admixed with high thermal conduction fillers to optimize TCE and thermal conductivity. Good integrity between the thick films and substrates led to promising results on sustaining heating performance without mechanical breaks up to 800oC. The high thermal conduction filler is believed to be responsible for the promising observation.

Keywords: Planar heating element, BN, thick film, thermal conductivity