Sintering and dielectric properties of B_2O_3 and LiF added $Ba(Mg,Zn)_{1/3}Nb_{2/3}O_3$ ceramics

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Abstract

The dielectric and microwave properties of $(x)BaZn_{1/3}Nb_{2/3}O_3$-$(1-x)BaMg_{1/3}Nb_{2/3}O_3$ (BMZN) mixture were investigated. The complex perovskite-type ceramics $Ba(Zn_{1/3}Nb_{2/3})O_3$ (BZN) and $Ba(Mg_{1/3}Nb_{2/3})O_3$ (BMN) have a high dielectric constant (ε_r = 39 and 33 respectively), but while BZN has a relative low firing temperature (~1350°C), BMN has a too high sintering temperature (>1500°C) to make it attractive in some technological applications. Mixing these two dielectric ceramics in different proportions and adding some sintering agents (like glassy B_2O_3 and LiF) the sintering temperature can be decreased, and XRD patterns indicates the formation of a solid solution for all x values investigated. The dielectric properties are preserved or even improved for some specific combinations. For BMZN (x = 1/4), without any dopants, the Qf factor is 76.7 THz for f = 7.6 GHz and the temperature coefficient of the resonant frequency τ_f is –4 ppm/°C, which is the best value for BMZN. These values make BMZN compounds suitable for microwave resonator applications.

We highlight in this paper that BMZN materials can be successfully sintered at low temperature (i.e. 940°C), opening opportunities to manufacture Base Metal Electrodes Multilayer Ceramic Capacitors (BME-MLCC).

Keywords: BMZN, Perovskites, Dielectric properties, Capacitors, Microwave resonators.