Effect of Sr Substitution for Ba on Microwave Dielectric Properties of Green Phase-Type $Sm_2(Ba_{1-x}Sr_x)Cu_{0.5}Zn_{0.5}O_5$ Solid Solutions

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The Y_2BaCuO_5 compound and their solid solutions which have the green phase-type structure have been reported to be the one of the high-Q microwave dielectric ceramics. In the case of $Sm_2BaCu_{0.5}Zn_{0.5}O_5$ compound, the $Q \times f$ value was of approximately 65000 GHz and the appropriate temperature coefficient of resonant frequency (τ_f) of –6.7 ppm/□ was obtained, though a near zero τ_f value is required for the commercial applications. Thus, in order to obtain the near zeroτ_f value by formation of the solid solutions, the $Sm_2(Ba_{1-x}Sr_x)Cu_{0.5}Zn_{0.5}O_5$ solid solutions were synthesized and then the microwave dielectric properties and the crystal structure of the solid solutions were investigated in this study.

The $Sm_2(Ba_{1-x}Sr_x)Cu_{0.5}Zn_{0.5}O_5$ solid solutions were sintered in the temperature range of 1075□ to 1250□ for 2h in air; the X-ray powder diffraction patterns of the samples showed the single phase in the composition range of 0 to 0.2. All the lattice parameters of the samples in the single phase region ($0 \leq x \leq 0.2$) linearly decreased with increasing the composition x. The dielectric constants (ε_r) of the solid solutions were approximately constant, whereas the $Q \times f$ values of the solid solutions decreased from 65000 to 10000 GHz, depending on the composition x. However, the temperature coefficients of resonant frequency of the solid solutions varied from negative to positive value. Thus, it was found that the small amounts of Sr substitution for Ba is effective in controlling the temperature coefficient of resonant frequency in the solid solutions. As a result, the appropriate microwave dielectric properties were obtained at x=0.05; these values are ε_r□18, $Q \times f$□21000 GHz and τ_f=1ppm/□, respectively.