Effect of ZnO and Bi_2O_3 Compund Addition on Microwave Dielectric properties of $(Zr_{0.8}Sn_{0.2})TiO_4$ Ceramics

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Microwave dielectric properties of (Zr,Sn)TiO_4 ceramics with addition of various dopants have been widely investigated. It has been reported that temperature coefficient of frequency(Tcf) of $(Zr_{0.8}Sn_{0.2})TiO_4$ ceramic is 0ppm/℃ and sintering temperatures over 1300℃ are required for (Zr,Sn)TiO4 ceramics to achieve relative densities over 90%. ($BaCuO_2$-CuO) ceramic which has a eutectic point at 926℃ has been used as a low temperature sintering aid and its addition to $(Zr_{0.8}Sn_{0.2})TiO_4$ ceramic enabled sintering to be done at 1000℃ with relative density of 93%. Also microwave dielectric properties of dielectric constant of 35.49 and Quality factor of 4000 at 7GHz were obtained. In this study ZnO and various Bi_2O_3 compounds which have eutectic points around 800℃ were added as low temperature sintering aids to $(Zr_{0.8}Sn_{0.2})TiO_4$ ceramic and its microwave dielectric properties and relative density in relation to sintering temperature was investigated.

$(Zr_{0.8}Sn_{0.2})TiO_4$ ceramic was prepared via conventional solid state synthesis. Each powder was weighed accordingly to Zr, Sn, Ti proportions and milled for 24hrs with deionized water. Then calcination was done at temperatures from 1150℃ to 1250℃. The calcined powders were remilled for 24hrs and then ZnO and various Bi_2O_3 compounds were added and mixed. Prepared powders were pressed into disks by a pressure of 1200kg/cm2 and then sintered at various temperatures. Microwave dielectric properties were measured by Hakki-colemann method and relative density was measured using AccuPyc 1330 Pycnometer. Also XRD analysis was done to investigate formation of secondary phases.

Addition of ZnO and Bi_2O_3 compounds enabled sintering to be done at temperatures lower than 1300℃. Variation of dielectric constant values depended more on sintering temperature than the amount of sintering aid. Q*fo values decreased significantly as the amount of sintering aid addition increased.