BiNbO$_4$ Ceramics in Microwaves: Synthesis and Characterization

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Abstract – The sintering behavior, microstructure and microwave dielectric properties of BiNbO$_4$ ceramics have been investigated. The phase-forming temperature (from orthorhombic to triclinic phase) of BiNbO$_4$ ceramics during sintering is lower than that (1025°C) of BiNbO$_4$ ceramics. The variations of dielectric constant and $Q$ value are also investigated. These compounds were prepared by the traditional solid state method. The phase purity and lattice parameters were studied by powder X-ray diffraction (XRD).

In this research, the properties dielectrics in microwaves of BiNbO$_4$ with phase transition was investigated as a function of sintering temperature. It is necessary to study the intrinsic properties of BiNbO$_4$ with phase transition to predict and control the dielectric properties at microwaves frequencies [1]. BiNbO$_4$ ceramics were prepared by the conventional mixed oxide method. The raw materials, Bi$_2$O$_3$ and Nb$_2$O$_5$, which had higher purity than 99.9%, were mixed for 2 hours in mill of high rotation with balls of ZrO$_2$, later roasted to several temperatures by 3h. Crystalline phases of the calcined powders and the sintered specimens were identified by XRD pattern analysis in the range 20 – 80° of using Cu Kα radiation. However, the phase BiNbO$_4$ roasted in the temperature of 850 °C, it presented a quite good result. The dielectric constant ($\varepsilon_r$) and the unloaded $Q$($1/\tan\delta$) of the specimens at 4-6 GHz were measured by Hakki and Coleman’s method. It can be studied for application in microwave device materials and in ceramic capacitors of multilayers [1,2].

**Figure 1**: Dielectric permittivity ($\varepsilon_r$) as a function concentration

- a) Doping PVA and b) Doping TEOS.

**Figure 2**: a) Tan loss as a function temperature. b) Dielectric permittivity ($\varepsilon_r$) as a function temperature.
