EFFECTS OF PROCESSING PARAMETERS ON THE DIELECTRIC PROPERTIES OF $Ca(Ti_{0.95}Li_{0.05})O_{2.85}F_{0.15}$ CERAMICS

A. MEZROUA[1], L. TAÏBI - BENZIADA[2]

[1] *U.E.R de Chimie Appliquée, EMP B.P. 17 Bordj-El-Bahri, Algiers, Algeria*

[2] *Laboratory of Materials Sciences, USTHB, B.P. 32 El-Alia , Bab-Ezzouar, Algiers , Algeria*

The aim of our works is the search for new ceramic materials with perovskite structure which could find applications in various fields such as mechanic, electronic, micro-electronic, aerospace…. Earlier, the investigation of the system (1-x) CaTiO3 - $xCaLiF_3$ allowed us to prepare a new solid solution with generalized formula $Ca(Ti_{1-x}Li_x)O_{3-3x}F_{3x}$ ($0 \leq x < 0.40$). The solubility of the fluoride $CaLiF_3$ in the host lattice $CaTiO_3$ lowers the sintering temperature from about 1400°C to 900°C and would reduce considerably the cost price of the component in which these materials could be used. The purpose of the present experimental study is to optimize the sintering parameters of ceramics with composition $Ca(Ti_{0.95}Li_{0.05})O_{2.85}F_{0.15}$.

The calcium titanate ($CaTiO_3$) is initially synthesized at about 850°C from an homogeneous mixture of calcium carbonate ($CaCO_3$) and titanium dioxide (TiO_2). Ceramics of composition $Ca(Ti_{0.95}Li_{0.05})O_{2.85}F_{0.15}$ are then elaborated starting from the nominal composition 0.95 $CaTiO_3$ + 0.05$CaLiF_3$. This powder mixture is finely milled for 1 hour in an agate grinder and disc tablets of 13mm diameter and about 1mm thickness are prepared by cold isostatic pressing. The pellets are sintered in free atmosphere at different temperatures (850, 950, 1000 or 1100°C) during 2, 4, 6 or 8 hours. The permittivity and the dielectric losses are followed as a function of temperature from 298K to 773K. The measurements are carried out in nitrogen (N_2) using a LCR data automatic capacitance bridge at two frequencies (100Hz or 1 kHz). Several phenomena are observed on the curves ε_r' - T and tanδ - T and could be ascribed to various structural changes.

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