$Bi(Mn_{1/3}Nb_{2/3})O_3$ keramikos laidumo tyrimas

Conductivity investigations of $Bi(Mn_{1/3}Nb_{2/3})O_3$ ceramics

Edita Palaimienė[1], J. Macutkevic[1], A. Molak[2], J.Banys[1]
[1]Vilniaus universitetas, Fizikos fakultetas, Saulėtekio al. 9, LT-10222 Vilnius
[2] Institute of Physics, University of Silesia, Ul. Uniwersytecka 4, PL-40-007 Katowice, Poland
edita.palaimiene@ff.vu.lt

The simple perovskite $BiMnO_3$ has received huge interest due to the coexistence of ferroelectricity and ferromagnetism. [1]. Multiferroic materials, in which electric and magnetic ordering coexist in a single phase, have attracted a lot of attention, as well as bismuth niobium manganate.

In this work we present broad band dielectric spectroscopy results of niobium bismuth manganite ceramic, $Bi(Mn_{1/3}Nb_{2/3})O_3$. Dielectric measurements were performed in wide temperature region (100 K – 500 K) at 20 Hz – 1 GHz frequencies. The new $Bi(Mn_{1/3}Nb_{2/3})O_3$ ceramics have been prepared by dry sintering, using a two-stage synthesis process in air [2].

We discuss results in terms of conductivity, specific resistance, and electrical modulus. At room temperatures the electrical conductivity dominates in the properties of ceramics. The electric conductivity σ* has been calculated according to the equation: $\sigma^* = i\varepsilon^*\varepsilon_0\omega$. In Fig. 1 is presented the frequency dependency of conductivity at different temperatures for $Bi(Mn_{1/3}Nb_{2/3})O_3$ ceramics. The conductivity follows the Almond-West power law $\sigma(\omega) = \sigma_{DC} + A\omega^s$, where σ_{DC} is the DC conductivity and $A\omega^s$ is the AC conductivity. From these dependencies it is possible to determine DC conductivity. One can calculate activation energy (E_A) and pre-exponential factor σ_0 of the conductivity according to the Arrhenius law $\sigma_{DC} = \sigma_0 \exp(-E_A/kT)$ (Fig. 1 Insert). Obtained parameters are $E_A = 0.44$ eV and $\sigma_0 = 153$ Sm^{-1}.

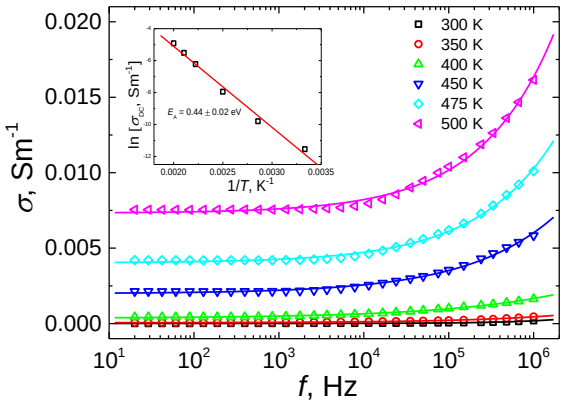

Fig. 1 Frequency dependencies of DC conductivity at different temperatures for $Bi(Mn_{1/3}Nb_{2/3})O_3$ ceramics. Inset, the 1/T dependence of σ_{DC} for $Bi(Mn_{1/3}Nb_{2/3})O_3$ ceramics.

Keywords: multiferroic, ceramic, dielectric.

References

[1] A.Moreira dos Santos et al., Solis State Comunications 122, 49-52 (2002).
[2] A. Molak, M. Pawełczyk, Ferroelectrics, **367**, 179–189 (2008).