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Programme
and Book of
Abstracts

4th Workshop

Fabrication, Properties & Applications of Electroceramic Nanostructures

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Fabrication, Properties & Applications of Electroceramic Nanostructures

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Preface

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PROPERTIES OF LANTHANUM DOPED BARIUM TITANATE PRODUCED FROM NANOPOWDERS

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As a first discovered ferroelectric ceramic, barium titanate has become one of the most extensively investigated ceramic materials used in electronics. For many years, A- and B-site dopants have been used to modify the electrical properties of $BaTiO_3$. In this paper, barium titanate doped with 0.3 mol% of lanthanum and sintered at different sintering times was investigated. Doped barium titanate nanopowder was prepared by doping pure barium titanate starting from citrate solutions of all components: barium, titanium and lanthanum. Experimental procedure was given in detail in previous reports [1]. Obtained powders were pressed in to pellets and sintered at 1300 °C for 2 and 16h in air atmosphere. The formation of phase and crystal structure of $BaTiO_3$ was carried out by XRD analysis. Microstructural properties such as grain size distribution and morphology of sintered samples were determined using scanning electron microscope. Measurement of dielectric constant and dielectric losses was provided in the frequency range of 20 to 10^6 Hz. The variation of the dielectric constant with temperature was measured in temperature interval from 20 to 180 °C.

The XRD analysis of doped barium titanate indicates the formation of tetragonal phase in samples sintered at both sintering times. Lanthanum has an influence on grain growth and shape of grains in doped barium titanate [2]. It was detected that the grain size also depends on sintering time. It can be notified the effect of lanthanum and sintering time on dielectric constant. Lanthanum also has influence on decreasing the Curie temperature of barium titanate. No frequency dependence of dielectric constant was detected.

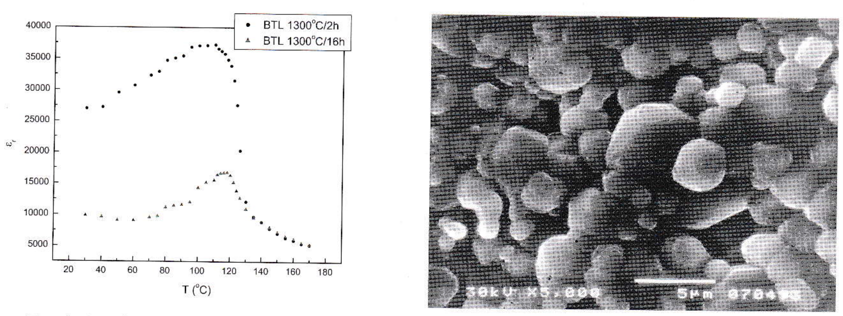

Fig.1. Dielectric constant vs. temperature and microstructure of barium titanate sintered sample

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COST-P-14

RAMAN STUDY OF FERROELECTRIC BISMUTH LAYER-OXIDE $ABi_4Ti_4O_{15}$ PREPARED BY THE MECHANOCHEMICAL SYNTHESIS

Z.Ž. Lazarević[1,*], N.Ž. Romčević[1], J. Bobić[2], N. Paunović[1], Z. Mitrović-Dohčević[1], B.D. Stojanović[2]

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Ferroelectric materials have innumerable properties related to their spontaneous polarization, for instance, pyre- and piezoelectricity, which are used for various sensors and actuators [1]. $BaBi_4Ti_4O_{15}$ (BBT) is an $n = 4$ member of the Bi-layer structured ferroelectric oxide family (Aurivillius phase) [2]. Bi-layered structure ferroelectric material - bismuth titanate, $Bi_4Ti_3O_{12}$ (BIT) and barium-bismuth titanate, $BaBi_4Ti_4O_{15}$ (BBT) ceramic powders were prepared by mechanical synthesis possess. $BaBi_4Ti_4O_{15}$ was prepared from stoichiometric quantities of barium titanate and bismuth titanate obtained via mechanochemical synthesis. Barium titanate, $BaTiO_3$ has been synthesised from mixture of BaO and TiO_2 and bismuth titanate, $Bi_4Ti_3O_{12}$ was prepared starting from Bi_2O_3 and TiO_2, commercially available. The reaction mechanism of BBT and the preparation and characteristics of BBT ceramic powders were studied using X-ray diffraction (XRD) and IR spectroscopy. The phonon modes have been studied by Raman spectroscopy. The Bi-layered perovskite structure of BBT ceramic forms at 1100 °C. Microstructure of $Bi_4Ti_3O_{12}$ is in accordance with the view that $Bi_4Ti_3O_{12}$ exhibits plate-like grains with thr average grain size increasing with the sintering temperature. It is evident that Ba^{2+} adition leads to the change in the microstructure development, particularly in the change of the average grain size and homogeneity of the grains of $BaBi_4Ti_4O_{15}$.

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J.D. Bobić[1], B.D.

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Barium bismuth titanate
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for high-temperature lead-free p
nonvolatile memories (Fe-RAM)

Barium-bismuth titanate
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$BaTi_3O_{12}$ has been synthesised f
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carried by TG/DTA methods a
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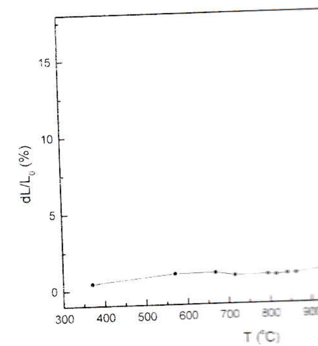

Fig. 1. Sintering curve of
of $BaTi_3O_{12}$ and

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[1] Miranda C., Costa M.E.V.,
(2001) 1303–1306.
[2] Jannet D.B., Maaoui M.E.,

COST-P-15

CHARACTERIZATION OF BARIUM BISMUTH TITANATE PREPARED BY MECHANICAL ASSISTED SYNTHESIS

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Barium bismuth titanate ($BaBi_4Ti_4O_{15}$ - BBiT) is an n=4 member of the Bi-base-layer-structure ferroelectric oxide family (Aurivillius phase). A lot of aspects of the preparation and properties of BBiT remain unexplored, whereas being promising candidate for high-temperature lead-free piezoelectric device, memory application and ferroelectric nonvolatile memories (Fe-RAM) [1,2].

Barium-bismuth titanate BBiT was prepared from stoichiometric quantities of $BaTi_3O_{12}$ and $Bi_4Ti_3O_{12}$ obtained via mechanically assisted synthesis in planetary ball mill. $BaTi_3O_{12}$ has been synthesised from mixture of BaO and TiO_2 and $Bi_4Ti_3O_{12}$ was prepared starting from Bi_2O_3 and TiO_2, commercially available. Characterization of this powder was carried by TG/DTA methods and measuring particle size distribution. Sintering curve of powder mixture of BT and BIT is presented on Fig. 1. This result is used to determinate appropriate temperature of sintering. The temperature range of sintering is narrow, from 1100°C to 1140°C.

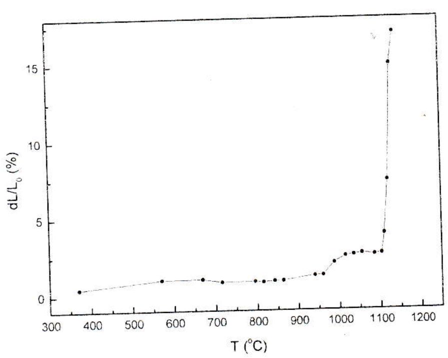

Fig. 1. Sintering curve of powder mixture of $BaTi_3O_{12}$ and $Bi_4Ti_3O_{12}$

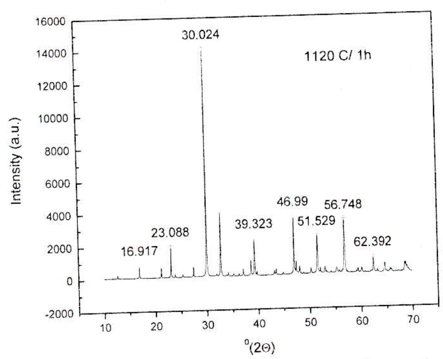

Fig. 2. XRD of BBiT ceramics sintered at 1120°C for 1h

Powder mixture of $BaTi_3O_{12}$ and $Bi_4Ti_3O_{12}$ was sintered at 1100°C, 1110°C and 1120°C for 1h and the density of sample is about 74,5%, 87,5%, 90.73%, respectively. The formation of phase and crystal structure BBiT were approved using X-ray analysis (Fig. 2). The microstructure and morphology of samples were investigated using scanning electron microscopy. Electrical properties of BBiT ceramics was also carried out.

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[2] Jannet D.B., Maaoui M.E., Mercurio J.P., *J. Electroceramics*, **11** (2003) 101–106.