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9th Students' Meeting
and
2nd ESR COST MP0904 Workshop

Book of Abstracts

SM 2011
COST SIMUFER

Novi Sad, Serbia, November 16-18, 2011

CONFERENCE for YOUNG SCIENTISTS

The Ninth Students' Meeting, SM-2011
The Second ESR Workshop, COST MP0904

PROGRAMME
and
BOOK OF ABSTRACTS

November 16-18, 2011
Novi Sad, Serbia

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A33

NIOBIUM DOPED BARIUM BISMUTH-TITANATE CERAMICS

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Ferroelectric materials with diffuse phase transition (DPT) charactreristics and/or relaxor properties have been exstensively studied in the last few decades mainly due to their very interesting and still not completely explained physical properties. According to that, the aim of our work is to investigate how niobium (Nb^{5+}) as donor dopant influences on microstructure and electrical properties in relaxor BBT ceramics.

Dense pure and doped $BaBi_4Ti_{4-5/4x}Nb_xO_{15}$ (BBNT) ceramics (x = 0, 0.05, 0.15, 0.30 mol) ceramics were prepared by conventional solid state reaction from appropriate oxide mixture. Dielectric properties were investigated in a wide range of temperatures and frequencies (Fig. 1). It is indicated that the temperature of dielectric constant maximum (T_m) of BBNT specimens significantly decreases with the increase of niobium content.

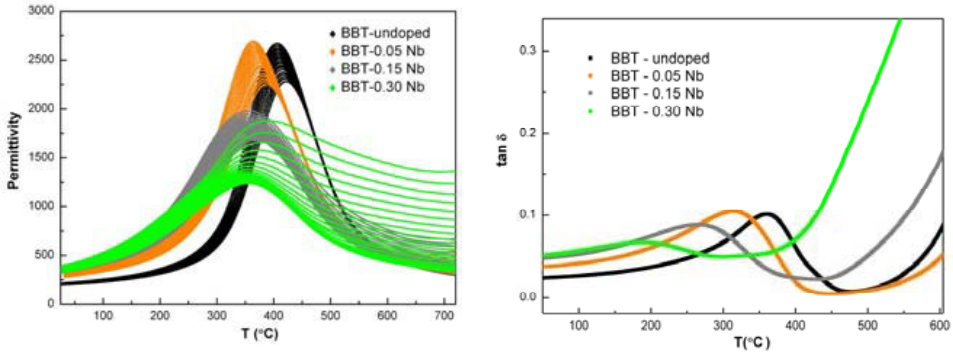

Figure 1. The temperature dependence of dielectric constant of pure and doped BBT at frequency range from 1 kHz to 1MHz and dielectric losses at 100 kHz

The dielectric relaxation rate follows the Vogel-Fulcher relation and fitting parameters which are measured at 100 kHz (T_{VF}, Ea, and f_o) are given in the table below.

Composition, x	ε_{RT}	T_m [K]	ε_m	Ea [eV]	T_{VF} [K]	f_o [Hz]
0	205	688	2430	0.023	660	$2.14 \cdot 10^9$
0.05	292	651	2424	0.204	555	$5.61 \cdot 10^{15}$
0.15	341	632	1770	0.040	594	$1.31 \cdot 10^{10}$
0.30	345	624	1300	0.001	621	$6.43 \cdot 10^6$

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BARIUM TITANATE PROPERTIES ENHANCED BY ATTRITION MILLING

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Barium titanate powder was prepared by soft chemical process from polymeric precursors (modified Pechini process). The obtained BT powder was nanosized with primary particles ~ 74 nm, but factor of agglomeration (F_{agg}) pointed on existence of agglomerates ~ 6 μm. It is well known that agglomerates could influence on setback of materials structure and properties. In order to de-agglomerate nanopowder and to improve BT properties, attrition milling was performed.

Barium titanate powder was treated in attrition mill with zirconia media for 1h in 2% polyacrylic acid. Milling induced reduction of agglomerates in size and number. Characterization of both starting (BT) and milled (BTA) powders was performed. The comparison of obtained results showed enhancement of powders properties generated by attrition milling. To investigate the effect of milling on electrical properties of ceramics, both BT powders were uniaxially pressed and sintered at 1300°C for 8 h in air. The density of BTA ceramics was 95 % of theoretical value and 90 % of BT. Temperature dependence of relative permittivity showed three structural transitions characteristic for ferroelectric BT ceramics. The temperature transition from ferroelectric to paraelectric was found to be at 120°C for BT and 122°C for BTA. Dielectric constant value was around 6700 for BTA which is much higher value in comparison with non-treated BT where permittivity was 1340. Dielectric losses were below 0.03 for both BT ceramics.

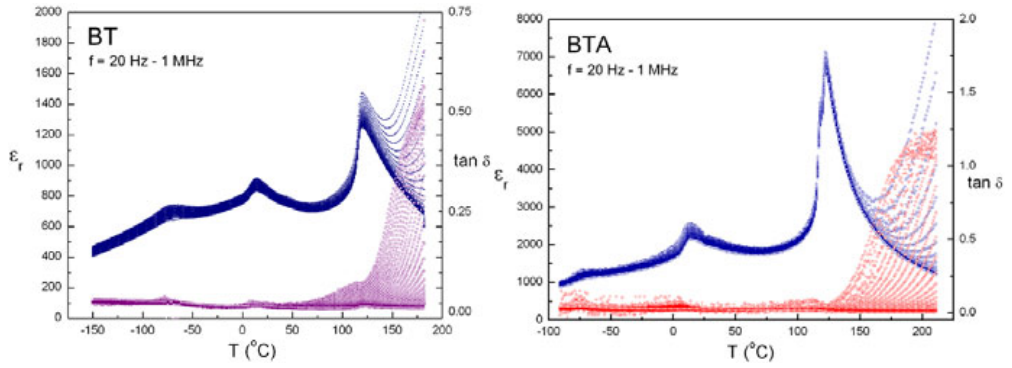

Figure 1 Dielectric properties of BT and BTA ceramics

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M7

FUNCTIONAL PROPERTIES OF PZT-$NiFe_2O_4$ MAGNETOELECTRIC CERAMIC COMPOSITES DESCRIBED BY EFFECTIVE FIELD MODELS

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Magnetoelectric composites of $x NiFe_2O_4$-$(1-x)Pb_{0.988}(Zr_{0.52}Ti_{0.48})_{0.976}Nb_{0.024}O_3$ (NFO-PZTNb) with x = 2, 5, 10, 20, 30% were prepared by citrate-nitrate combustion using PZTNb-based template powders. To ensure a better connectivity of dissimilar phases, chemical methods for preparation of *in-situ* composites, followed by adequate sintering procedure was employed.

The dielectric constant of the composites decreases with the increasing the addition of x, as a consequence of the sum property. The dielectric responses show a Debye relaxation in the range of 10^2–10^4 Hz and a Maxwell-Wagner relaxation for frequencies below 10 Hz and the corresponding maximum is shifted with increasing of ferrite content to higher frequency. The magnetic properties were investigated. The initial permeability increased with increasing NFO content, which indicates that the