FOURTEENTH YOUNG RESEARCHERS' CONFERENCE
MATERIALS SCIENCE AND ENGINEERING

December 9-11, 2015, Belgrade, Serbia
Serbian Academy of Sciences and Arts, Knez Mihailova 36

Program and the Book of Abstracts

Materials Research Society of Serbia
&
Institute of Technical Sciences of SASA

December 2015, Belgrade, Serbia

Book title:
Fourteenth Young Researchers' Conference - Materials Science and Engineering: Program and the Book of Abstracts

Publisher:
Institute of Technical Sciences of SASA
Knez Mihailova 35/IV, 11000 Belgrade, Serbia
Tel: +381-11-2636994, fax: 2185263
http://www.itn.sanu.ac.rs

Editor:
Dr. Smilja Marković

Technical Editor:
Aleksandra Stojičić

Cover page: Aleksandra Stojičić and Milica Ševkušić
Cover: modified photo *Belgrade bridges* by mcveja; Flickr (https://www.flickr.com/photos/mcveja/2428406067/); CC-BY 2.0 Generic

Printer:
Gama digital centar
Autoput No. 6, 11070 Belgrade, Serbia
Tel: +381-11-6306992, 6306962
http://www.gdc.rs

Edition:
100 copies

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

66.017/.018(048)

YOUNG Researchers Conference Materials Sciences and Engineering (14th ; 2015 ; Beograd)
Program ; and the Book of Abstracts / Fourteenth Young Researchers' Conference Materials Sciences and Engineering, December 9-11, 2015, Belgrade, Serbia ; [organized by] Materials Research Society of Serbia & Institute of Technical Sciences of SASA ; [editor Smilja Marković]. - Belgrade : Institute of Technical Sciences of SASA, 2015 (Beograd : Gama digital centar). - XVI, 58 str. ; 23 cm

Tiraž 100. - Registar.

ISBN 978-86-80321-31-8
1. Materials Research Society of Serbia (Beograd)
a) Наука о материјалима - Апстракти b) Технички материјали - Апстракти
COBISS.SR-ID 219496972

10-4

The crystal structure, microstructure, and dielectric properties of $BaTi_{1-x}Sn_xO_3$ (x = 0, 0.05 and 0.1) ceramics sintered in different atmospheres (air and Ar)

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Due to specific dielectric and ferroelectric properties, functional ceramics based on barium titanate ($BaTiO_3$) have found application in semiconductor industries. Appropriate electrical properties of barium titanate-based materials, such as magnitude of relative dielectric permittivity and the Curie temperature, could be achieved by varying the sintering conditions (which influenced ceramics' microstructure) and/or by doping with various cations.
Here, we investigated an influence of sintering atmosphere (air and argon) on the crystal structure, microstructure, and dielectric properties of barium titanate-stannate (BTS; $BaTi_{1-x}Sn_xO_3$) ceramics. The BTS powders (with x = 0, 0.05 and 0.1; denoted BT, BTS5 and BTS 10, respectively) were synthesized by solid-state reaction technique. In the following, the powders were uniaxially pressed (P = 240 MPa) into cylindrical compacts (∅ 6 mm and $h \approx$ 2 mm) and sintered in SETSYS TMA (Setaram Instrumentation, Caluire, France) by heating rate of 10 °/min up 1420 °C and with dwell time of 2 hours. To establish the influence of a sintering atmosphere two sets of experiments were performed: (1) in air, and (2) in Ar. During sintering, the shrinkage was recorded in axial (h) direction. The crystal structure of BTS ceramics were studied at room temperature by X-ray diffractometry and Raman spectroscopy. The microstructure and chemical (Ti/Sn) composition were examined by SEM–EDS methods. The electrical measurements were made in air, at 1 kHz using a Wayne Kerr Universal Bridge B224; the measurements were done in cooling, from 160 to 20 °C. A profound effect of argon atmosphere on the magnitude of relative dielectric permittivity of sintered BTS ceramics has been found.