Electroceramics XVII

International Conference

Virtual Darmstadt

24 – 28 August 2020

BOOK OF ABSTRACTS

ELECTRO CERAMICS

ECERS

TECHNISCHE UNIVERSITÄT DARMSTADT

Table of Contents

AF-1: Antiferroelectrics 1/2

AF-2: Antiferroelectrics 2/2 (FLAME session)

BE-1: Bio-Electroceramics

Closing session

DI-1: Dielectrics

DI-2: Dielectrics

DI-3: Dielectrics

DI-4: Dielectrics

DI-5: Dielectrics

DI-6: Dielectrics

DI-7: Dielectrics

EC-1: Electrocalorics

EL-1: Electronics - Ferroelectrics thin films

EL-2: Electronics - Memories and conductors

EL-3: Electronics - Memristors

Exhibitor area

IC-1: Ion Conductors

IC-2 - Ion Conductors

IC-3: Ion Conductors

IC-4: Ion Conductors

IC-5: Ion Conductors

IC-6: Ion Conductors

IC-7: Ion Conductors

IC-8: Ion Conductors

IC-9: Ion Conductors

IC-10: Ion Conductors

IC-11: Ion Conductors

MM-1: Multiferroics & Magnetism - BFO bulk

MM-2: Multiferroics & Magnetism - BFO interaction with light, catalysis

MM-3: Multiferroics & Magnetism - Multiferroic thin films

MM-4: Multiferroics & Magnetism - Multiferroics

MM-5: Multiferroics & Magnetism - Magnetism

Opening Session

Panel discussion: Feedback on online conferencing, pros and cons

Panel discussion: Future cross-fertilization of material classes

Panel discussion: Future applications of electroceramics

PF-1: Piezoelectrics/Ferroelectrics - Processing 1/3

PF-2: Piezoelectrics/Ferroelectrics - Processing 2/3

PF-3: Piezoelectrics/Ferroelectrics - Processing 3/3

PF-4: Piezoelectrics/Ferroelectrics - Domain Walls 1/2

PF-5: Piezoelectrics/Ferroelectrics - Domain Walls 2/2

PF-6: Piezoelectrics/Ferroelectrics - Textured piezoelectrics and thick films 1/2

PF-7: Piezoelectrics/Ferroelectrics - Textured piezoelectrics and thick films 2/2

PF-8: Piezoelectrics/Ferroelectrics - Processing composites and devices 1/2

PF-9: Piezoelectrics/Ferroelectrics - Processing composites and devices 2/2

PF-10: Piezoelectrics/Ferroelectrics - Lead-free 1/2 (NBT-based)

PF-11: Piezoelectrics/Ferroelectrics - Lead-free 2/2 (KNN-based)

PF-12: Piezoelectrics/Ferroelectrics - Processing thin films 1/2

PF-13: Piezoelectrics/Ferroelectrics - Processing thin films 2/2

PF-14: Piezoelectrics/Ferroelectrics - Structure, relaxors 1/3

PF-15: Piezoelectrics/Ferroelectrics - Structure, relaxors 2/3

PF-16: Piezoelectrics/Ferroelectrics - Structure, relaxors 3/3

PF-17: Piezoelectrics/Ferroelectrics - Microstructure-properties relation 1/2

PF-18: Piezoelectrics/Ferroelectrics - Microstructure-properties relation 2/2

PF-19: Piezoelectrics/Ferroelectrics - Non-oxide ferroelectrics/dielectrics

Plenary-1: Prof. Olivier Guillon

Plenary-2: Prof. Philippe Ghosez

Plenary-3: Prof. Heli Jantunen

Plenary-4: Prof. James M. LeBeau

PR-1: Processing (broad)

Poster session 1: Ferroelectrics, antiferroelectrics, multiferroics I

Poster session 2: Energy materials and magnetism I

Poster session 3: Ferroelectrics, antiferroelectrics, multiferroics II

Poster session 4: Energy materials and magnetism II

Sponsor session

TE-1: Thermoelectrics

TH-1: Thermistors

Lead-free piezoelectric flexible films

Poster

Dr . Mirjana Vijatovic Petrovic [1], ***Dr . Floriana Rusanescu Craciun*** [2], ***Dr . Francesco Cordero*** [2], ***Dr . Elisa Mercadelli*** [3], ***Dr . Carmen Galassi*** [3], ***Dr . Nikola Ilic*** [4], ***Dr . Jelena Bobic*** [4], ***Mr . Elisabetta Brunengo*** [5], ***Dr . Paola Stagnaro*** [5]

1. *Institute for Multidisciplinary Research, University of Belgrade, Kneza Viseslava 1, 11000 Belgrade* , ***2.*** *CNR-ISM, Istituto di Struttura della Materia, Area della Ricerca di Tor Vergata, Via del Fosso del Cavaliere, 100, I-00133, Rome, Italy* , ***3.*** *CNR-ISTEC, Istituto di Scienza e Tecnologia dei Materiali Ceramici, Via Granarolo 64, I-48018 Faenza, Italy* , ***4.*** *Institute for Multidisciplinary Research, University of Belgrade, Kneza Viseslava 1, Belgrade, Serbia* , ***5.*** *CNR-SCITEC, Istituto di Scienze e Tecnologie Chimiche, Via de Marini 6, 16149, Genoa, Italy*

The growing interest in science community today is finding the ways to safely use mechanical energy which is being released in small portions around us. The idea of this work is to use vibrational energy present everywhere in small quantities to power the small-scale electronic devices used in everyday life. Flexible electronics, which can be bent, rolled, and stretched into arbitrary shapes, would significantly expand the application of modern electronic devices [1, 2].

As a lead-free piezoelectric material bismuth sodium titanate-barium titanate (BNBT) was selected and prepared by a solid state reaction. Since, polymer polyvinylidene fluoride (PVDF) has interesting properties and advantages over the other polymers, it was used as a matrix for the processing of polymer/ceramics flexible films by hot pressing. Implementation of piezoelectric powder into the matrix of α- phase PVDF was performed under the carefully optimized conditions of temperature and pressure. Three different volume rations of active phase vs. polymer (BNBT 30, 35 and 40 vol%) were used for the preparation of flexible films. The homogeneous distribution of piezoelectric powder in the polymer was obtained. IR analysis pointed that after the hot pressing, in the obtained flexible films, there is a transformation of electrically inactive PVDF α-phase into electrically active β and γ phases. Ferroelectric analysis evidenced the difficulties to obtain fully saturated hysteresis loops in inhomogeneous ferroelectric materials due to the formation of charge layers at the ferroactive-polymer phase interfaces. The dielectric permittivity for 40 vol% is nearly two times higher than for 30 vol% and eight times higher than for pure PVDF, while the losses at room temperature (at 1 kHz) remain below 3 %. Anelastic measurements confirmed the results obtained with the dielectric spectroscopy.

[1] A. Jain et al. Polymer Engineering and Science, (2015) 1589-1616

[2] H. Li, Applied Physics Reviews 1, 041301 (2014)