Innovation Center of Faculty of Mechanical Engineering

Faculty of Mechanical Engineering, University of Belgrade

Center for Business Trainings

CNN TECH

„International Conference of Experimental and Numerical Investigations and New Technologies“

Sponsored by:

MINISTRY OF EDUCATION, SCIENCE AND TECHNICAL DEVELOPMENT

OF THE REPUBLIC OF SERBIA

Programme

and

The Book of Abstracts

29 June – 02 July 2021

Zlatibor, Serbia

„International Conference of Experimental and Numerical Investigations and New Technologies“

CNN TECH 2021

29 June – 02 July 2021

Hotel Mona, Miladina Pecinara 26, Zlatibor, Serbia

http://cnntechno.com

Programme

and

The Book of Abstracts

Organised by:

Innovation Center of Faculty of Mechanical Engineering

Faculty of Mechanical Engineering, University of Belgrade

Center for Business Trainings

Sponsored by:

Ministry of Education, Science and Technical development of the Republic of Serbia

Title:	International Conference of Experimental and Numerical Investigations and New Technologies – **CNN TECH 2021** **PROGRAMME AND THE BOOK OF ABSTRACTS**
Publisher:	Innovation Center of Faculty of Mechanical Engineering Kraljice Marije 16, 11120 Belgrade 35 tel: (+381 11) 3302-346, fax 3370364 e-mail: cnntechno@gmail.com web site: http://cnntechno.com, http://www.inovacionicentar.rs
Editors:	Dr Goran Mladenovic, Associate Professor Dr Martina Balac, Senior Scientific Researcher Dr Aleksandra Dragicevic, Scientific Researcher
Technical editor	Dr Goran Mladenovic, Associate Professor
Cover page:	Dr Goran Mladenovic, Associate Professor
Printed in:	Innovation Center of Faculty of Mechanical Engineering Kraljice Marije 16 11120 Belgrade 35 tel: (+381 11) 3302-346
Circulation:	100 copies. The end of printing: June 2021.

ISBN: 978-86-6060-077-8

“International Conference of Experimental and Numerical Investigations and New Technologies”

CNN TECH 2021

SCIENTIFIC COMMITTEE:

Milos Milosevic, Serbia (chairman)
Nenad Mitrovic, Serbia (co-chairman)
Aleksandar Sedmak, Serbia
Hloch Sergej, Slovakia
Drazan Kozak, Croatia
Nenad Gubeljak Slovenia
Monka Peter, Slovakia
Snezana Kirin, Serbia
Samardzic Ivan, Croatia
Martina Balac, Serbia
Mládková Ludmila, Czech Republic
Johanyák Zsolt Csaba, Hungary
Igor Svetel, Serbia
Aleksandra Mitrovic, Serbia
Valentin Birdeanu, Romania
Danilo Nikolic, Montenegro
Goran Mladenovic, Serbia
Bajic Darko, Montenegro
Tasko Manski, Srbija
Luis Reis, Portugal
Zarko Miskovic, Serbia
Tozan Hakan, Turkey
Nikola Momcilovic, Serbia
Traussnigg Udo, Austria
Gordana Bakic, Serbia
Katarina Colic, Serbia
Peter Horňak, Slovakia
Róbert Huňady, Slovakia
Martin Hagara, Slovakia
Jovan Tanaskovic, Serbia
Aleksa Milovanovic, Serbia
Marija Durkovic, Serbia
Tsanka Dikova, Bulgaria
Ján Danko, Slovakia
Ognjen Pekovic, Serbia
Jelena Svorcan, Serbia
Suzana Filipovic, Serbia
Darko Kosanovic, Serbia
Nebojsa Manic, Serbia
Zorana Golubovic, Serbia
Vera Pavlovic, Serbia

ORGANIZING COMMITTEE:

Nenad Mitrovic (chairman)
Milos Milosevic (co-chairman)
Aleksandar Sedmak
Martina Balac
Vesna Miletic
Igor Svetel
Goran Mladenovic
Aleksandra Mitrovic
Aleksandra Dragicevic
Zarko Miskovic
Katarina Colic
Milan Travica
Dragana Perovic
Aleksandra Joksimovic
Beti Kostadinovska Dimitrovska
Tsanka Dikova
Isaak Trajkovic
Toni Ivanov
Snezana Kirin
Igor Stankovic
Ivana Vasovic Maksimovic
Nina Obradovic
Andreja Stojic
Ivana Jevtic

enterprise europe network
Business Support on Your Doorstep

MEASUREMENT OF DIELECTRIC PERMITTIVITY USING COAXIAL CHAMBERS AND ELECTROMAGNETIC-MODELING SOFTWARE

N. Obradovic[1]*, A. Peles[1], J. Petrovic[2], D. Olcan[2], W. G. Fahrenholtz[3], A. Djordjevic[2,4], V. B. Pavlovic[5]

[1]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, 11000 Belgrade, Serbia

[2]University of Belgrade – School of Electrical Engineering, Bulevar Kralja Aleksandra 73, 11120 Belgrade, Serbia

[3]Materials Science and Engineering, Missouri University of Science and Technology, Rolla, MO 65409, USA

[4]Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, 11000 Belgrade, Serbia

[5]University of Belgrade – Faculty of Agriculture, Nemanjina 6, 11080 Belgrade – Zemun, Serbia

**Corresponding author e-mail:* nina.obradovic@itn.sanu.ac.rs

Abstract

Our research group has developed a method for measurement of complex relative permittivity of various dielectric materials in the frequency range from around 1 kHz up to several GHz. Material samples have preferably a disk shape. The thicknesses of the samples can be in a wide range, from about 10 μm (thick films) up to several mm. We have designed and manufactured a set of coaxial chambers, which we use as test fixtures. We have also developed two numerical-simulation programs for the electromagnetic analysis of bodies with rotational symmetry. One program is suitable for the low-frequency analysis. It is based on an electrostatic approach. The other program is based on an electrodynamic approach and it is tailored for microwave frequencies. In measurements, we use impedance meters and network analyzers to obtain the input impedance of a chamber with a sample. Thereafter, we implement our software for the electromagnetic modeling to extract the relative permittivity of the measured sample. As examples of verification of our method, we present here results for the relative permittivities of two sets of samples whose sizes are on the extreme limits of the method. The first set comprises poly (vinylidene fluoride) and mechanically activated ZnO nanoparticle composite films, whose relative permittivities are around 1.8. The second set comprises large, high-density samples of spinel (aluminum magnesium oxide) ceramics, sintered under various conditions. The measured relative permittivities of these samples are around 7.5. In all cases, good agreement with other available data has been obtained.

Keywords

Permittivity, Measurements, Electromagnetic-modeling software, Ceramic materials, PVDF

Acknowledgement

This paper was supported by the Project F133 of the Serbian Academy of Sciences and Arts and by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

621(048)(0.034.2)
62:519.6(048)(0.034.2)

INTERNATIONAL Conference of Experimental and Numerical Investigations and New Technologies (2021 ; Zlatibor)

Programme [Elektronski izvor] ; and The Book of Abstracts /
International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH 2021,29 June - 02 July 2021, Zlatibor, Serbia ; organized by Innovation Center of Faculty of Mechanical Engineering [and] Faculty of Mechanical Engineering, University of Belgrade, Center for Business Trainings ; [editors Goran Mladenovic, Martina Balac, Aleksandra Dragicevic]. - Belgrade : Innovation Center of Faculty of Mechanical Engineering, 2021 (Belgrade : Innovation Center of Faculty of Mechanical Engineering). - 1 elektronski optički disk (CD-ROM) ; 12 cm

Sistemski zahtevi: Nisu navedeni. - Nasl. sa naslovne strane dokumenta. - Tiraž 100

ISBN 978-86-6060-077-8

1. Mašinski fakultet. Inovacioni centar (Beograd)

a) Машинство - Апстракти b) Техника - Нумерички методи - Апстракти

COBISS.SR-ID 41811977