

# **2021 International Workshop on Impedance Spectroscopy (IWIS 2021)**

**Chemnitz, Germany  
29 September – 1 October 2021**



**IEEE Catalog Number: CFP21BO8-POD  
ISBN: 978-1-6654-9473-1**

**Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP21BO8-POD
ISBN (Print-On-Demand):	978-1-6654-9473-1
ISBN (Online):	978-1-6654-9472-4

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# Table of content

## Fundamentals

Modeling Reflections in a Complex Cable Structure with Impedance Mismatches <i>Haddad D. et al</i> . . . . .	1
Linear Kramers-Kronig with Tikhonov Regularization for Impedance Spectra with Logarithmic Frequency Distribution Correction <i>Kallel A. Y. et al</i> . . . . .	7

## Materials and Corrosion

Microfluidic-based Electrical Impedance Spectroscopy System Using Multilevel Lamination of Dry Film Photoresist <i>Cao Y. et al</i> . . . . .	11
Studying the Barrier Quality of Al <sub>2</sub> O <sub>3</sub> Oxide Layers <i>Wünscher H. et al</i> . . . . .	15
Copper-Free Click Chemistry Assisted Antibodies Immobilization for Immunosens- ing of IL-10 Cytokine <i>Hilali N. et al</i> . . . . .	20
Comparative Study of Lead-free Ferroelectric Nanoparticles to Boost the Per- formance of Flexible Nanogenerators <i>Jeder K. et al</i> . . . . .	26
Lead-Free Ba <sub>0.85</sub> Ca <sub>0.15</sub> Zr <sub>0.1</sub> Ti <sub>0.1</sub> O <sub>3</sub> for High Piezoelectric Performance Flex- ible Nanogenerator <i>Missaoui S. et al</i> . . . . .	30
Fostering Piezoelectric Performance of Flexible Nanogenerators Using Zn Doped Ba <sub>0.85</sub> Ca <sub>0.15</sub> Zr <sub>0.1</sub> Ti <sub>0.9</sub> O <sub>3</sub> <i>Ben Ayed A. et al</i> . . . . .	33

## Energy

Oxygen Transport Impedance in a Polymer Electrolyte Membrane Fuel Cell Equivalent Electrical Circuit <i>Aït-Idir W. et al</i> . . . . .	36
Impact of Sulfide-based Solid Electrolyte Particle Size Distribution on the Elec- trochemistry of ASSB via Impedance Study <i>Ghanshyam Y. N. et al</i> . . . . .	40

Comparative Study of Excitation Signals for Microcontroller-based EIS Measurement on Li-Ion Batteries <i>Fischer A. et al</i> . . . . .	44
--	----

## Bioimpedance

Cole-Cole Parameter Extraction from Electrical Impedance Spectroscopy for Real-time Monitoring of Vegetal Tissue: Case Study with a Single Celery Stalk <i>Aouane S. et al</i> . . . . .	48
Preliminary Investigation of the Impact of Mechanical Stresses on Bioimpedance Spectroscopy-based Insuline Bioavailability Assessment <i>Arpaia P. et al</i> . . . . .	52
Early Altered Cells Health Status Detection via Label-free Impedance and Broadband Dielectric Spectroscopy <i>Ambrico M. et al</i> . . . . .	56
Contact Testing of an Impedance-based Cancer Detection Probe <i>Skorina E. H. et al</i> . . . . .	60
Changes in the Dielectric Spectra of Tumors in a Xenograft Model for Colon Cancer <i>Sabuncu A. C. et al</i> . . . . .	64
Impedance Properties of Trabecular Bone based on Different Analytical Methods <i>Wei W. et al</i> . . . . .	68
High-frequency Impedance Spectroscopy for Biotechnological Applications <i>Zaikou Y. et al</i> . . . . .	70
Dielectric Relaxation of Iron Corrosion Products in Limestone under Saline Environment <i>Fan B. et al</i> . . . . .	76
Using Electrochemical Impedance Spectroscopy to Study the in vivo Evolution of the Electrochemical Properties of Neural Implants <i>Hélias V. et al</i> . . . . .	80
Impact of Magnetic Field on Yeast Cells Monitored by Impedance Spectroscopy <i>Viet H. V. et al</i> . . . . .	85
Robust Advanced Sensor System for Determination of Volatile Organic Compounds (VOC) <i>Mangler A. et al</i> . . . . .	89

## Sensors

Electrochemical Sensor for 4-aminophenol Based on Flexible Laser-induced Graphene <i>Nasraoui S. et al</i> . . . . .	94
Investigation and Implementation of Elastomer Filament Strain Sensors for Monitoring of Hand Gestures <i>Bautista-Quijano J. R. et al</i> . . . . .	97

An Impedimetric Sensor for Levothyroxine Detection Towards Point of Care Applications <i>David M. et al</i> . . . . .	99
Development of Silicon-based Micro-sensor for Selective Methanol Discrimination and Detection Over Interfering VOC <i>Musa I. et al</i> . . . . .	104
Soft Nanocomposite-based Pressure Sensors as Smart Seals <i>Bautista-Quijano J. R. et al</i> . . . . .	110

## Electrical Impedance Tomography

Two-dimensional Forward Modeling for Human Thorax Imaging Based on Electrical Impedance Tomography <i>Bader O. et al</i> . . . . .	114
3D Image Reconstruction Based on Electrical Impedance Tomography Measurements using a Gauss-newton Algorithm <i>Hafsa M. et al</i> . . . . .	118
Hand Gesture Recognition Based on Electrical Impedance Tomography Measurements using Genetic Algorithms <i>Hafsa M. et al</i> . . . . .	123
Forward Modelling and Image Reconstruction with Post-Processing for Human Thorax Imaging based on Electrical Impedance Tomography Measurements <i>Haddad H. et al</i> . . . . .	126

## Machine Learning and Artificial Intelligence in Impedance Spectroscopy

A Crest-factor Optimization Algorithm for Multisine Signals Based on the Evolutionary Role Playing Game Theory <i>Kallel A. Y. et al</i> . . . . .	131
Comparative Study of Optimization Methods Proposed for the Extreme Learning Machine (ELM) <i>Chouikh T. et al</i> . . . . .	137
Epileptic Seizure Motion Classification based on sEMG and Artificial Neural Network <i>Djermal A. et al</i> . . . . .	141
Comparative Study of Different Salp Swarm Algorithm Improvements for Feature Selection Applications <i>Choura A. et al</i> . . . . .	146