

Chairman's Welcome Message

The exchange of ideas and concepts over different fields of science is an important first step to find innovative solutions for the future and present problems of mankind. It is the aspired aim of the international workshop on impedance spectroscopy (IWIS) to assemble innovative and experienced scientists and different countries to discuss on methods, instrumentation and results of the recent research work in the fields of electro chemistry, material science, biology and medicine, electronics and sensors. The Advanced School on Impedance Spectroscopy (ASIS), which takes place for the second time this year, provides a good overview of basics all around the method and make it better accessible for young scientists. An exhibition informs about the latest news concerning measurement equipment and devices. These are main components of this annual international workshop taking place at Technische Universität Chemnitz.

In its 11th edition, the IWIS workshop includes more than 50 contributions from 11 countries in 8 sessions, 6 plenary talks, 10 tutorials and 2 workshops. Selected contributions from the workshop will be published as post conference proceedings in international journals. The peer reviewed contributions aim to highlight new advances and present different approaches in dealing with impedance spectroscopy including modeling, measurement and applications.

The Circle of Experts in Impedance Spectroscopy (CEIS) will be hold its annual meeting to discuss novel topics together within a network of outstanding specialists and professionals from science and industry.

The organization of the workshop has requested a considerable effort of the organizing team from the chair for measurement and sensor technology which makes it possible to organize this international event actually within Technische Universität Chemnitz.

We thank the IEEE Instrumentation and Measurement Society for supporting the Advanced School on Impedance Spectroscopy and the IEEE Instrumentation and Measurement Chapter Germany for the assistance of the event. The workshop is co-organized by the Chemnitz School of Metrology (CSM e.V.), whose support for the event is highly acknowledged.

We would like to thank you for choosing IWIS 2018 and for coming to Chemnitz.

Prof. Olfa Kanoun & Dr. Norbert Wagner
General Chairs

IWIS 2018 Organizers

General Chairs

O. Kanoun (DE) N. Wagner (DE)

Program committee chair

A.Y. Kallel (DE)

Honorary chair

H.-R. Tränkler (DE)

Program Committee

M. Ates (TR)	E. Barsoukov (US)	R. Bayford (UK)
P. Bertemes-Filho (BR)	P. L. Bonora (IT)	R. Bragos (ES)
M. Danzer (DE)	A. Errachid (FR)	M. Ferreira (PT)
J. Fleig (AT)	R. A. Gerhardt (USA)	A. Hartov (US)
J. Haueisen (DE)	Ch. Hübner (DE)	E. Ivers-Tiffée (DE)
N. Jaff.-Renault (FR)	A. Jossen (DE)	D. Klotz (USA)
S. Leonhardt (DE)	D. Macdonald (US)	Ø. G. Martinsen (NO)
M. Min (EE)	S. C. Mukhopadhyay (NZ)	U. F. Pliquet (DE)
P. Ramos (ES)	A. Robitzki (DE)	B. Roling (DE)
D. U. Sauer (DE)	M. Schneider (DE)	G. Smith (UK)
W. Strunz (DE)	B. Tribollet (FR)	M. Ulbrich (DE)
J. Vereecken (BE)	W. Vonau (DE)	W. Yang (UK)

Program Chair of ASIS

A. Al-Hamry (DE)

Publication chair

A.Y. Kallel (DE)

Organizing Committee Chair

T. Keutel (DE)

Organisation Committee

R. Barioul (DE)	G. Bouattour (DE)	D. El-Houssaini (DE)
A.Y. Kallel (DE)	F. Keil (DE)	S. Khriji (DE)
H. Nouri (DE)	K. Schütze (DE)	F. Wendler (DE)

Contact Information

Chair for Measurement and Sensor Technology

Technische Universität Chemnitz

Reichenhainer Straße 70

09126 Chemnitz

Germany

Tel: +49 (0)371 / 531 - 24480

Fax: +49 (0)371 / 531 - 824480

Email: mst@tu-chemnitz.de

URL: <http://www.tu-chemnitz.de/iwis>

General Information

The City of Chemnitz

Chemnitz has its unique story - of groundbreaking inventions in automotive engineering, mechanical engineering or the textile industry as well as of courageous companies like Richard Hartmann, Carl Gottlieb Haubold or Louis Schönherr. As a modern industrial city, Chemnitz has continued to write its history and is today one of the fastest-growing cities in Germany. The city is a center of technology with a focus on the automotive and supplier industries, information technology and mechanical and plant engineering.



Industry Museum,
(©www.chemnitz2025.de)



Rathaus, Neumarkt (©CWE - Chemnitz)

Going down their own path, experiencing with new adventures and inventions - this recipe makes the city Chemnitz and its people successful:

thousands of patented ideas like the thermos flask or the first mild detergent were conceived here. Today, Chemnitz as an important link in the global manufacturing chain, produces excellent machines and production facilities for the whole world.

Tradition and modernity are also reflected in exciting urban contrasts. Unique evidences like “das Bauhaus” and “die neue Sachlichkeit” or the Kaßberg, one of the largest intact area of Wilhelminian style architecture in Europe, are the deeply loved by the architecture fans. Just like Chemnitz city centre, which has been redesigned over the past 20 years by internationally renowned architects such as Helmut Jahn, Hans Kollhoff and Christoph Ingenhoven.



Buildings in Jugendstyle in the famous Chemnitz-Kaßberg (4.5 km² protected area as a historic monument), (www.chemnitz.de)

For lovers of the fine arts there is a lot to discover in Chemnitz: For example, the Chemnitz Art Collections or the Gunzenhauser Museum, which houses one of the most impressive collections of classical modern art. Meanwhile, the Saxon Industrial Museum traces its history and present. The Municipal Theatres with the Robert-Schumann-Philharmonie attract visitors from all over Germany.

A side-trip to the more than 100-year-old town hall is also worthwhile: the monumental Klinger-mural “Arbeit - Wohlstand - Schönheit” can be admired in the town council hall. The council hall is adorned with the work

“Die Abwägung” by Neo Rauch, one of the most important contemporary artists.

Those who simply want to relax will also find a place in Chemnitz: recreation islands such as the castle pond with the adjoining kitchen forest invite you to stroll and linger as well as the historic city park along Chemnitz.

Let Chemnitz surprise you, go to discover the city by yourself - it's worth it!



TU Chemnitz, Zentrales Hörsaal- und Seminargebäude (©www.chemnitz.de)

Bars & Restaurants

If you want to spend an evening in the modern city-center of Chemnitz, there are a couple of nice bars and restaurants around. You may want to try the following:

Brazil – Innere Klosterstraße 10, www.restaurant-brazil.de

Buono – Theaterstraße 7, www.bouno-chemnitz.de www.buschfunk-chemnitz.de

City Pub – Brückenstraße 17, www.tower-pub.de

Diebels Fasskeller – An der Markthalle 3, www.fasskeller.de

Janssen – Schloßstraße 12, www.janssen-restaurant.de

Ratskeller – Markt 1, www.ratskeller-chemnitz.de

Tillmanns – Brückenstraße 17, www.tillmanns-chemnitz.de

Turmbrauhaus – Neumarkt 2, www.turmbrauhaus.de

Conference Venue

The International Workshop on Impedance Spectroscopy will take place at the Campus of Chemnitz University of Technology. You can find it at:

Technische Universität Chemnitz
Neues Hörsaal und Seminargebäude (Orangerie)
Reichenhainer Straße 90
09126 Chemnitz

IWIS Special Dinner – Schönherrfabrik (Fabrik-Küche Max Louis)

The networking Dinner will be held in the Fabrik-Küche Max Louis (Schönherrfabrik) Restaurant located nearby Schönherr Park, Küchwald and Schlossteich lake. A place renowned for its calming nature. This networking Dinner provides scientists and industrials from different fields: Battery, bio-impedance, fuel cells, sensors, materials and measurement systems, the opportunity to spend more time with each other and discuss actual challenges and trends.



Fabrik-Küche Max Louis

After dinner the participants have the opportunity to take part in a guided tour through the Schönherrfabrik.

History of the Schönherrfabrik:

- 1799 - cotton mill by Wöhler and Lange
- 1821 - spinning and weaving mill by Haubold
- 1836 - sold to Saxon Engineering Compagnie → first engineering company
- 1851 - Louis Schönherr and Seidel start the production of looms, 1854 in the Saxon Engineering Compagnie building
- 1872 - foundation of Saxon Loom Factory (The Schönherrs own the most shares)
- 1916 - vortex destroys some buildings of Schönherr Factory
- 1945 - blitzes destroys some buildings of Schönherr Factory
- 1945/46 - dismantling and reconstruction → VEB Textima Karl-Marx-Stadt
- 1990 - Chemnitzer Webmaschinenbau GmbH, later Schönherr WEBA GmbH
- 2000 - Schönherr Kulturfabrik (today 83 000 m² area)

Getting from the Hotel to the restaurant:

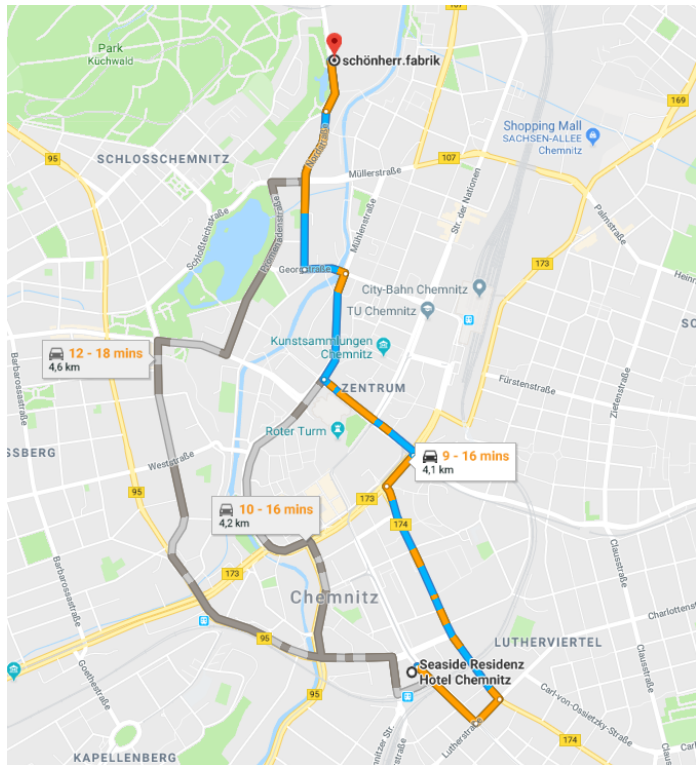
By car via Zschopauer Str./B174:

- Take Zschopauer Str./B174 for around 1.1 km
- Use the right 2 lanes to turn right onto Bahnhofstraße/B169/B173
- Turn left onto Brückenstraße after around 500m, then right onto Mühlenstraße after around 500m.
- Turn right onto Nordstraße
- Nordstraße turns slightly right and becomes Schönherrstraße.

By tram:

- From the front of the hotel, take Tram 2 ‘Bernsdorf’ in direction of ‘Brückenstr./Freie Presse’
- Get off at ‘Stefan-Heym-Platz’

- Take bus 23 in direction of ‘Heinersdorf, Chemnitz’
- Get off at the station ‘Schönherrpark, Chemnitz’



Hotel to Schönherr-fabrik

IWIS Social Program – Visit to the August Horch Museum in Zwickau

August Horch Museum – one of the most admirable automobile jewel collection throughout Germany: From Horch to Audi to Wanderer, AutoUnion(-racing car), DKW, IFA F8/9, Sachsenring P 240, Trabant and its never seen follower-prototype to VW.

Zwickau celebrates its 900th anniversary in 2018. It is the center of the Saxon automotive industry, with a tradition of over one hundred years including car makers Horch, Audi, Auto Union, Trabant and Volkswagen.



August Horch Museum

Travel to Chemnitz

You can reach *Technische Universität Chemnitz* via car or train.

By car from Autobahn A72:

- Take the motorway exit ‘15-Chemnitz Süd’
- Use B173 / Neefestraße direction ‘Stadtzentrum’
- After 1 km turn right on the B169 / ‘Südring’
- After 5.5 km use exit ‘Reichenhainer Straße’ direction ‘Technische Universität’
- You’ll reach campus after 1.5 km. The conference venue is on the left

By car from Autobahn A4:

- Take the motorway exit ‘Chemnitz Mitte’ in direction to the city centre.
- Follow the road for about 5 km. There are several big crossings.
- Always go straight until there are signs to turn right to the ‘Reichenhainer Straße’ and to ‘Technische Universität’.
- After 1.5 km you’ll reach the campus, the conference venue is on the left side. Next to the Mensa is a -car park- where 30 places are reserved.

By train:

- Get off at Chemnitz central station and use tram 3 in direction ‘Technopark Chemnitz’, alternatively local trains C13, C14 or C15 in direction ‘Technopark Chemnitz’
- Get off at ‘TU Campus (Reichenhainer Straße)’

Airport:

- The next nearby Airports are Dresden and Leipzig
- From airport Dresden go into A4 direction Chemnitz/Erfurt.
- From airport Leipzig-Halle go into A14 direction Dresden, at ‘Dreieck Nossen’
- Go on A4 direction Chemnitz/Erfurt. Proceed as described above.

Taxi: If you need a taxi in Chemnitz please call: +49 371 369 000

Getting Around in Chemnitz

Most of the buses and trams in Chemnitz meet at the Central Bus Station ('Zentralhaltestelle').

Information about public transport and timetables you can find here:

www.cvag.de

www.opnvkarte.de

www.bahn.de

It is possible to use Android/iPhone app DB Navigator from the app store. (<https://www.bahn.com/en/view/booking-information/booking/db-navigator-app.shtml>)



Getting from the Hotel Seaside Residenz to the workshop venue:

By feet:

15 minutes of walk.

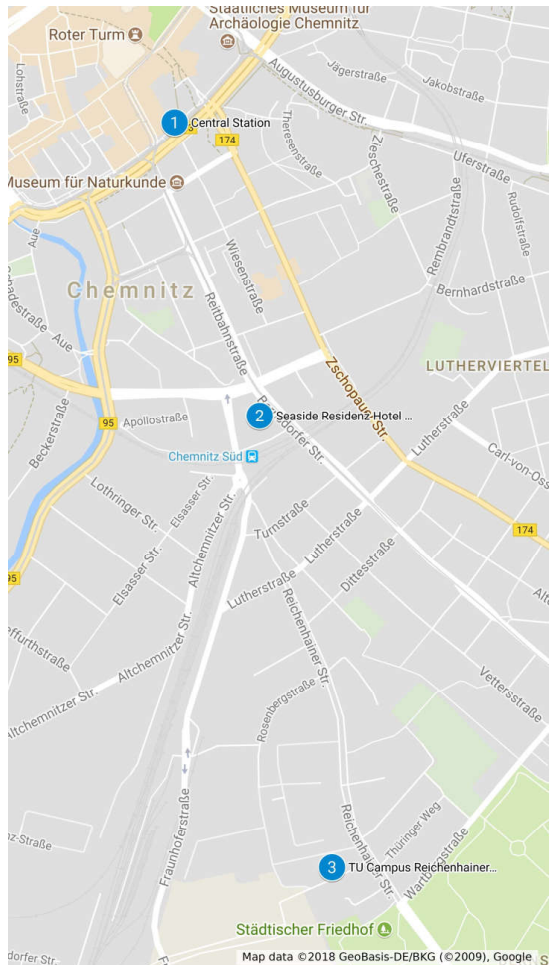
By Tram/Train:

In front of the hotel, you will find 'Bernsbachplatz' train/tram station. Take Tram 3, alternatively Train C13, C14 or C15 to the direction 'Technopark Chemnitz'. The station at university is named 'TU Campus' and is just in front of the workshop venue.

Map of Chemnitz City Center

Chemnitz Map

- ① Central Station
- ② Seaside Residenz Hotel Chemnitz
- ③ TU Campus Reichenhainerstrasse



Internet Access

During the event, a Wi-Fi access is available at the campus site. Please use the following registration information to log in:

Network name **tu-chemnitz.de**

WPA2 key **iwis2018**

If you have problems connecting to the network, please ask organizers for help at the workshop desk.

Sponsors

The workshop is supported by:

- School of Metrology CSM e.V.



- IEEE Instrumentation & Measurement Society



- IEEE IM Chapter Germany Section



- The main sponsor from industry:



Together with all the exhibitors listed in the next page

Exhibition

During the workshop, the following exhibitors will be present:



ASIS Program

Tuesday, September 25th, 2018

08:30 – 08:45	Registration
08:45 – 09:45	Tutorial 1 Basics on Electrochemistry, Phase Boundaries and Cell Potentials Prof. R. Gruden, DHBW Stuttgart
09:45 – 10:00	Discussion
10:00 – 11:00	Tutorial 2 Fundamentals on Impedance Measurement and Material Characterization B. Schweiger, Keysight Technologies GmbH
11:00 – 11:30	Coffee Break
11:30 – 12:30	Tutorial 3 Electrochemical Sensors: Basic Principles and Some Actual Applications Prof. L. G. Paterno, Institute of Chemistry, University of Brasilia, Brazil
12:30 – 13:30	Lunch, Exhibition
13:30 – 14:30	Tutorial 4 Impedance Spectroscopy Instrumentation: Concepts and Tips Prof. P. Bertemes-Filho, State University of Santa Catarina, Joinville, Brazil
14:30 – 14:45	Discussion

14:45 – 15:45	Tutorial 5 Electrochemical Impedance Spectroscopy in Supercapacitors Prof. Dr. Murat Ates, Namik Kemal University, Tekirdag, Turkey
15:45 – 16:15	Coffee Break
16:15 – 17:15	Tutorial 6 “Debugging” of Impedance Spectra Dr. W. Strunz, Zahner elektrik, Kronach, Germany
17:15 – 17:30	Discussion
17:30 – 19:00	Workshop Arduino-based Impedance Spectroscopy Rajarajan Ramalingame, Renato Torres

Battery Workshop:

08:45 – 11:00	Workshop Hands on Training on Lithium-ion Battery Cells: Part I F. Steger
11:00 – 11:30	Coffee Break
11:30 – 12:30	Workshop Hands on Training on Lithium-ion Battery Cells: Part II F. Steger
12:30 – 13:30	Lunch, Exhibition
13:30 – 15:45	Workshop Hands on Training on Lithium-ion Battery Cells: Part III F. Steger
15:45 – 16:15	Coffee Break
16:15 – 19:00	Workshop Hands on Training on Lithium-ion Battery Cells: Part IV F. Steger

Wednesday, September 26th, 2018

08:30 – 08:45	Registration
08:45 – 09:45	Tutorial 7 Signal Processing for Impedance Spectroscopy Prof. O. Kanoun, Technische Universität Chemnitz, Germany
09:45 – 10:00	Discussion
10:00 – 11:00	Tutorial 8 Electrochemical Tools for the Characterization of Sensors based on Silicon Technology Prof. A. Errachid, Université Lyon 1, CNRS, France
11:00 – 11:30	Coffee Break
11:30 – 12:30	Tutorial 9 Bioimpedance Basics: Choosing the Instrumentation M. Bulst, Sciospec Scientific Instruments GmbH, Wurzen - Germany
12:30 – 13:30	Lunch, Exhibition
13:30 – 14:30	Tutorial 10 High-Resolution Impedance Sensing: Circuits, Instrumen- tation and Applications Prof. M. Carminati, Politecnico di Milano, Milano, Italy
14:30 – 14:45	Discussion
14:45 – 19:00	Social Program August-Horch-Museum (Zwickau)

Battery Workshop:

08:45 – 11:00	Workshop Hands on Training on Lithium-ion Battery Cells: Part V F. Steger
11:00 – 11:30	Coffee Break
11:30 – 12:30	Workshop Hands on Training on Lithium-ion Battery Cells: Part VI F. Steger
12:30 – 13:30	Lunch, Exhibition

IWIS Program

Thursday, September 27th, 2018

- 08:00 – 08:45 **Registration (Registration Desk)**
- 08:45 – 09:00 **Opening**
Chair: Prof. Olfa Kanoun
- 09:00 – 09:35 **Plenary Talk 1**
Chair: Prof. Olfa Kanoun
Impedance Spectroscopy in Solid State Electrochemistry;
Prof. Jürgen Fleig
- 09:35 – 10:10 **Plenary Talk 2**
Chair: Prof. Olfa Kanoun
Model-free Distribution of Relaxation Times (DRT) Analysis
for the Characterization of Resistive-Capacitive and Resistive-
Inductive Impedance Spectra; *Prof. Dr.-Ing. Michael Danzer*
- 10:10 – 10:40 **Coffee Break**
- Session 1a - Battery I**
Chair: Prof. Roman Gruden
- 10:40 – 12:00 Measurement Uncertainty Contributions of Electrochemical Im-
pedance Spectroscopy Data of Li-ion Batteries; *Jessica Heine et al*

Compensation of Nonlinear Excitation in Impedance Spectra of
Automotive Lithium-Ion Cells; *Peter Haußmann et al*

Characterisation Methodologies of Internal Impedance of Lithium-
ion Cell and their Comparison; *Anup Barai et al*

Parameter Extraction of Transient Measurements According to a
Fractional Equivalent Circuit; *Werner Strunz et al*

Session 1b - Measurement Systems

Chair: Dr.-Ing. Dino Klotz

10:40 – 12:00 High-Resolution Ratiometric Method with Embedded MCU for Hz and Sub-Hz Impedance Analysis Based on Voltage-to-Frequency Converters; *Andreas Mangler et al*

A Wideband Electronic Calibration System for Electrochemical Impedance Analysis; *Christopher Lüke et al*

Velocity Measurement in Rolling Mills using Impedance Analysis - Optimized Calibration Process for Changing the Measuring Frequency Instantly using Polynomial Regression; *Mario Radschun et al*

Adaptive Filtering to Enhance Noise Immunity of Immittance Spectroscopy: Comparison with Fourier Transformation; *Daniil Stupin et al*

12:00 – 13:00 **Lunch, Exhibition**

13:00 – 13:35 **Plenary Talk 3**

Chair: Prof. Dr.-Ing. Michael Danzer

Generalized Electrochemical Impedance Spectroscopy: Analyzing Solid-Gas Interfaces Optically; *Dr.-Ing. Dino Klotz*

13:35 – 14:20 **Exhibitors Presentations**

Rutronik

Sciospec

Zahner Messsysteme

Keysight Technologies

Wayne Kerr Electronics

OMICRON Lab

14:20 – 14:55 **Plenary Talk 4**

Chair: Prof. Olfa Kanoun

Probing Tissue with Impedance Spectroscopy: Signal Constrains; *Prof. Pedro Bertemes-Filho*

14:55 – 15:55 **Poster Session & Student Award Embedded Systems**

14:55 – 15:55 **Circle of Experts Impedance Spectroscopy (CEIS)**

Session 2a - Fuel cells

Chair: Prof. Jürgen Fleig

15:55 – 17:15 Identification of Characteristic Frequency by Means of Distribution of Relaxation Time and Bode's Diagram in Cathodes for Solid Oxide Fuel Cells; *Davide Clematis et al*

EIS through Time Domain Fractional Order Identification; *Gjorgji Nusev et al*

Multivariate Statistical Fault Detection Based on Wavelet Transform with an Application on Fuel Cells; *Martin Stepancic et al*

Electrochemical Pressure Impedance Spectroscopy (EPIS): A Promising Diagnostic Tool for Fuel Cells; *Lutz Schiffer et al*

Session 2b - Bio-impedance I

Chair: Prof. Pedro Bertemes-Filho

15:55 – 17:15 3D Bioimpedance Model of the Human Lower Leg; *Stephan Dahlmanns et al*

Preliminary Study of Fibrotic Cardiac Tissues Characterization using Impedance Spectroscopy; *Amélie Degache et al*

Transurethral Resection: An Electric Equivalent Circuit Model for Bipolar Resectoscopes; *Tino Morgrenstern et al*

Detection of Bacteria Concentration in Emulsion Liquid using Electrical Impedance Spectroscopy; *Rogério Pereira et al*

18:30 – 23:00 **Special Dinner**

Schönherr-fabrik

<https://www.schoenherrfabrik.de/>

Friday, September 28th, 2018

08:00 – 08:30 **Registration (Registration Desk)**

08:30 – 09:05 **Plenary Talk 5**

Chair: Prof. Olfa Kanoun

Dielectric and Impedance Spectroscopy of Insulating and Conducting Materials; *Prof. Rosario A. Gerhardt*

09:05 – 09:40 **Plenary Talk 6**

Chair: Prof. Olfa Kanoun

Graphene based Nanocomposites with EIS Analysis for Supercapacitors; *Prof. Murat Ates*

09:40 – 10:00 **Coffee Break**

Session 3 - Materials & Sensors I

Chair: Prof. Rosario A. Gerhardt

10:00 – 11:00 Modeling the Impedance Spectra of Li₁₀GeP₂S₁₂ as a Solid Electrolyte for Lithium all-solid-state Batteries; *Marta Cazorla Soult et al*

Highly Selective Ion Imprinted Sensor Based on Nanoparticles-Polyaniline Modified Glassy Carbon Electrode for Nitrate Determination; *Houda Essousi et al*

Use of Molecularly Imprinted Polymers for the Rapid and Accurate Detection of Sepsis; *Nikolaos Demertzis et al*

Session 4a - Bio-impedance II

Chair: Prof. Pedro Bertemes-Filho

11:00 – 12:00 Dynamic Impedance Spectroscopy for Characterization of Non-linear Objects; *Uwe Pliquet et al*

Investigation of Electrical Impedance Myography Utility for Fingers Gesture Distinguishing; *Sirine Ilahi et al*

Characterization of Poultry Meat using Impedance Spectroscopy; *Hanen Nouri et al*

Session 4b - Battery II

Chair: Prof. Roman Gruden

11:00 – 12:00 Spatially-Resolved Electrochemical Impedance Spectroscopy on Lead-Acid Test Cells; *Monika Kwiecien et al*

Modeling of impedance of a lithium-ion Battery with Electrodes Modified by Carbon Nanotubes; *Renat Sibatov et al*

Charge transfer kinetics of Li-intercalation in $\text{Li}(\text{Ni}_{0.6}\text{Co}_{0.2}\text{Mn}_{0.2})\text{O}_2$; *Alexander Nickol et al*

12:00 – 13:00 **Lunch, Exhibition**

Session 5 - Materials & Sensors II

Chair: Prof. Leonardo Paterno

13:00 – 14:40 Compensating for the Effects of Conductive Soiling During Capacitive Limit Level Sensing; *Christian Weber et al*

Roll Gap Measurement in Rolling Mills Using Impedance Analysis - A First Experimental Setup with a Pot Core Coil as Sensor; *Annette Jobst et al*

Impedance properties of Planar Supercapacitors using carbon Nanotube forests of Different Heights; *Evgeniy Kitsyuk et al*

Prevention of the Reaction Between Iron Nanoparticles and Alumina Carriers during Sintering Process; *Fatima Blelletta et al*

Electrochemical Impedance Study of the Influence of Theine on the Corrosion Behavior of Co-Cr based Dental Alloy; *Noureddine Leguedani et al*

14:40–14:50 **Closure**

Chair: Prof. Olfa Kanoun

Publications series

O. Kanoun (Ed.)

Progress Reports on Impedance Spectroscopy

Vol. 1, ISBN 978-3-11-044756-9, 2016

Lecture Notes on Impedance Spectroscopy: Measurement, Modeling and Applications

Vol. 5, ISBN 978-1-138-02754-1 (Hbk), 2015

Vol. 4, ISBN 978-1-138-00140-4 (Hbk), 2014

Vol. 3, ISBN 978-0-415-64430-3 (Hbk), 2012

Vol. 2, ISBN 978-0-415-69838-2 (Hbk), 2012

Vol. 1, ISBN 978-0-415-68405-7 (Hbk), 2011

Selected contributions from the IWIS 2018 will be published in the International Journal on Sensors and Instrumentation Systems, Inderscience.