

ELECTROCHEMISTRY - A SCIENCE THAT LIVES IN BELGRADE

Metal candle, rusty nails, disinfectant, artificial hips and an album with signatures of world-famous scientists were just some of the exhibits at the exhibition *Meet Electrochemistry Through Belgrade School of Electrochemistry*, held from September 1 to September 19, 2020 at the SASA Gallery of Science and Technology in Belgrade. Although at a first glance, they have nothing in common, all of them are related to electrochemistry, a science that is one of the few for which Serbia and Belgrade are globally recognized, but about which general public knows very little. The term in

the title – Belgrade School of Electrochemistry, does not mark an institution, a building or even a community. It marks the people and their knowledge, achievements and results. The School has no date of establishment nor a defined start date, and we hope it will not have an end either. It has been created as a result of efforts by several generations of scientists to accumulate knowledge and pass it onto the next generations, to contribute with their research and their results to conquering new knowledge and advancement of the entire society.

The exhibition, prepared by the Institute for Chemistry, Technology and Metallurgy at the Belgrade University, Museum of Science and Technology in Belgrade and SASA Gallery of Science and Technology, consisted of two informal parts: short introduction to electrochemistry, its main principles and the most important areas and short historical overview of the development of Belgrade School

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Window of the SASA Gallery of Science and Technology during the exhibition



of Electrochemistry and presentation of its founders and the most distinguished representatives. It has been organized as one of the most significant events within the celebration of the year 2020 as the Year of Electrochemistry, which was, in order to promote this science, as well as motivate the young people to devote themselves to it, established by 13 scientific organizations and institutions by signing the Declaration of Establishment on November 29, 2019.

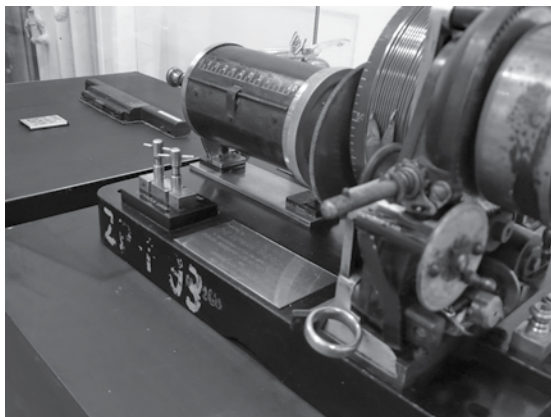
More than five years ago, when a small group of electrochemists from Belgrade applied to be the hosts of the 71st Annual Meeting of the International Society of Electrochemistry - ISE, very few people actually believed that they will get it. However, largely thanks to the reputation of the Belgrade School of Electrochemistry, Belgrade was chosen as the host of the meeting that was supposed to take place from August 30 to September 4, 2020. That is when they

got the idea to organize an exhibition during the meeting, which would present the tradition and achievements of electrochemistry in Belgrade to the global electrochemical community gathered in the Serbian capital. Unfortunately, pandemic of corona virus has disturbed all of the plans. The Annual meeting of the International Society of Electrochemistry was cancelled and transformed into an online meeting, and all the other scientific meetings, as well as most of the other planned events, were cancelled as well, so the exhibition became the largest and the most important event in the celebration of the Year of Electrochemistry. The Exhibition opening was held on September 1, with a live stream from the SASA Gallery of Science and Technology on the YouTube channel,¹ and it was opened by a live address

¹ A video recording of the exhibition opening and the film, which was shown at the SASA Gallery of Science and Technology during the exhibition, as well as all the other video materials related to the exhibition, are permanently available on the YouTube channel: www.youtube.com/channel/UCso-6abAeMthpDDjEvAMRMA



Commercial polarograph manufactured in Czechoslovakia in the mid-1920s (manufacturer: V. and J. Nejedly). Jaroslav Heyrovský won the Nobel Prize in 1957 for the development of polarography as an analytical method. In the background: Lithium-ion batteries – the last Nobel Prize for Chemistry in 2019 was awarded for their development



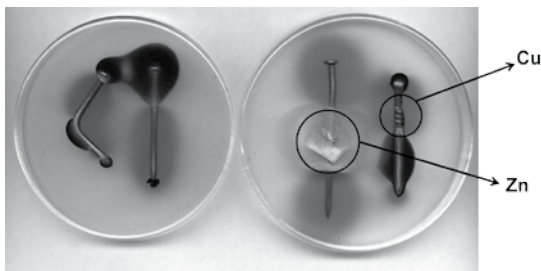
from Stanley Whittingham, one of the three winners of the last Nobel Prize for Chemistry (in 2019, for the discovery and development of Lithium-Ion batteries).²

The first part of the exhibition reveals what is electrochemistry and presents its most important areas: electrochemical sources of electric energy; corrosion and corrosion protection; electrochemical metal deposition and dissolution; application of electrochemistry in the synthesis of biomaterials for medical applications; electrochemical technologies – industrial electrochemistry

² He divided Nobel Prize with John Goodenough and Akira Yoshino.

and electroanalytical chemistry, which made Belgrade electrochemistry globally recognized. The choice of exhibits and texts in the catalogue that follow this part of the exhibition have been made in a way that enables each visitor to understand the basic electrochemical processes and phenomena and to recognize them in their surroundings, and reveal to the young people what is the subject of this science and offer them enough information so that they could choose electrochemistry as their possible field of professional career. That is how the visitors were able to learn, and read in the catalogue, where and how they meet electrochemistry in everyday life, from mobile devices to blood sugar measurements, why electrochemistry offers the only sustainable and durable solution for the problem of energy production and storage, the amount of metal eaten by rust every minute and how much that costs us, everything we can measure by electrochemical methods and

Demonstration of the electrochemical iron corrosion:
 Left - Impact of mechanical strain
 Right - Impact of contact with another metal (galvanic corrosion)



how electrochemistry helps us protect against corona virus, which two Nobel Prizes were awarded for achievements in the field of electrochemistry, how to obtain copper and aluminum, etc.

The second part of the exhibition is dedicated to the history of electrochemistry in Belgrade, origins and the development of the Belgrade School of Electrochemistry, as well as the people who were its founders and the most distinguished representatives. It can be traced back to the late 19th century, when academician and the first Rector of the Belgrade University, Sima Lozanić, did research in the field of electrosynthesis under the influence of silent electric discharge. Although those were not true electrochemical experiments, they were

the first that studied reactions under the impact of electricity. Documented beginning of electrochemical education in Serbia dates back to 1903, when Prof. Miloje Stojiljković began teaching Physical chemistry at the Great School in Belgrade and its curriculum also included *Chemical statics with electrochemistry*. After the First World War, in 1920, at the Department for Mechanical Engineering at the Faculty of Technology, professor Nikola Pušin introduced the first specialized electrochemical education through the subject *Electrochemistry and electrometallurgy*, while several years later, they've established a Laboratory for physical chemistry and electrochemistry, which in 1930, with the construction of the new building of the Faculty of Technology at the Kralja Aleksandra Boulevard, developed into an Institute. After the Second World War and a series of transformations of the Faculty of Technology, Panta Tutundžić, a young associate at the Institute,

► became the first Dean of the newly formed Faculty of Technology, nowadays Faculty of Technology and Metallurgy, in the 1950s and there he established a Department of Physical Chemistry and Electrochemistry with a unique, and still rare in the world, specialized electrochemical education at the undergraduate studies. In parallel, as an honorary professor, he held lectures at the Faculty of Natural and Mathematical Sciences at the University of Belgrade, and his student, later academician Milenko Šušić, took over his role and become the initiator of the second center of electrochemical education in Belgrade at the Faculty of Natural and Mathematical Sciences. Today's Faculty of Physical Chemistry sprang out

of it. The carrier of further development of electrochemistry at that Faculty was professor Šušić's student, academicians Slavko Mentus.

Over the next few decades, electrochemical science in Belgrade developed greatly, new institutes and research units were established, and two of professor Tutundžić's students, academicians Aleksandar Despić and Dragutin Dražić, with their work in research and education, first of all, thanks to their intensive collaboration with the most important electrochemists of their time, created the term Belgrade School of Electrochemistry, a name that will become well-recognized in the entire world of electrochemistry. Due to the events in this region in the 1990s, the development of the Belgrade School of Electrochemistry stagnated in the late 20th and early 21st century, but a renewed rise is evident in the last couple of years.

Catalogue for the exhibition includes the description of the most



Detail
from the
exhibition

important fields of research and the most significant results of the members of the Belgrade School of Electrochemistry, with a special review of the ones that made it globally recognized, from the development and advancement of electroanalytical methods and BDD mechanisms of iron corrosion (it was named after the initials of its authors – Bockris, Despić, Dražić), through the development of metal candle, achievement of technology for production of activated titanium electrodes and commercialization of those results via *HLOROGEN*[®] plant, to the latest achievements in the energy production and storage. At the end of the chapter, there is an overview of all the fields of electrochemistry that have been and are still researched within the Belgrade School of Electrochemistry, as well as the list of names of almost all the researchers who have been and still are part of the School.

Short biographies of the six, according to the author's selection, most important members of the Belgrade



Wheatstone bridge, Felten & Guillaume, Germany, 1930s

School of Electrochemistry, academicians Aleksandar Despić, Dragutin Dražić, Milenko Šušić, Radoslav Adžić, Slavko Mentus and Dr Nenad Marković, conclude the textual part of the catalogue, while the list and photographs of the exhibits presented at the exhibition are given at the end of the catalogue.

A forty-minute film that could be seen at the exhibition is permanently available on the aforementioned YouTube channel: www.youtube.com/channel/UCso-6abAeMthpDDjEvAMRMA ■