

## Vladimir Sergeevich Bagotsky

### *Scientist and Teacher*

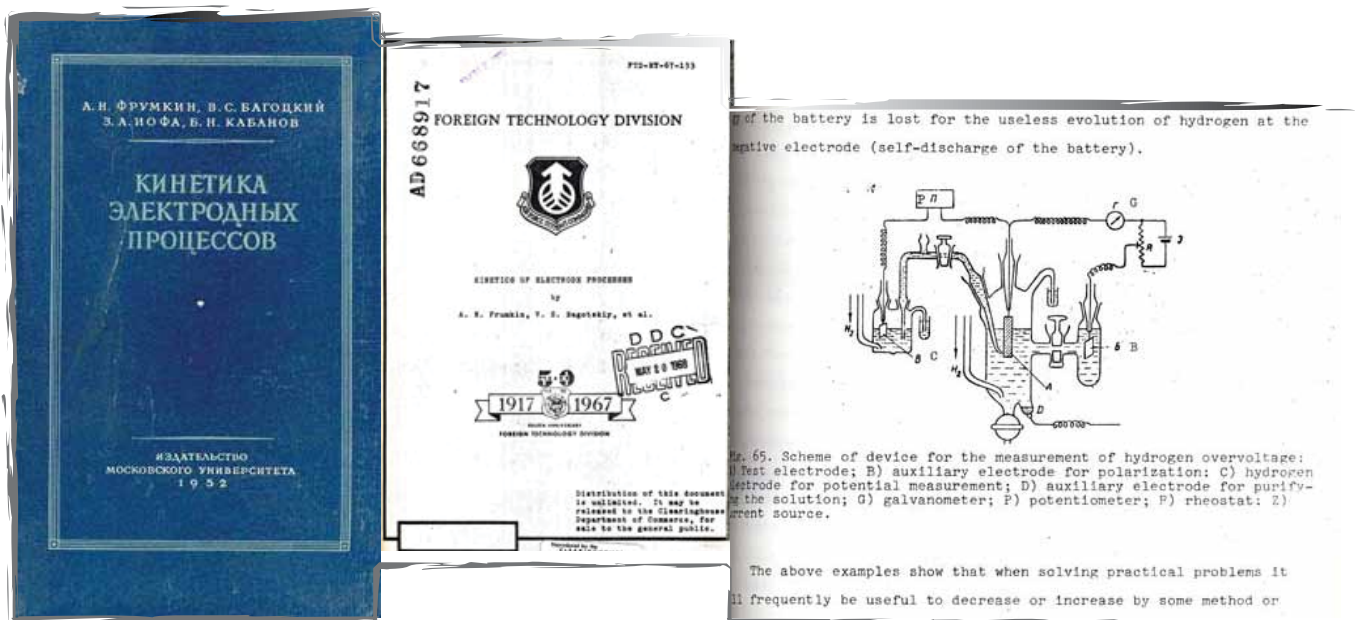
#### 1920-2012



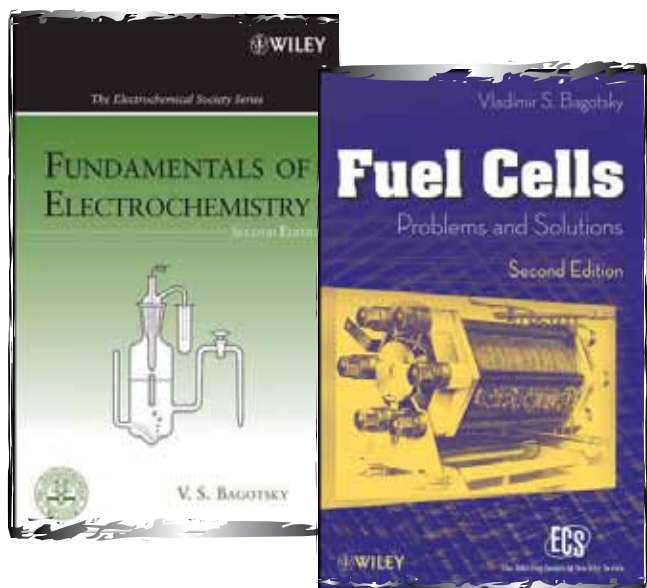
**V**LADIMIR SERGEEVICH BAGOTSKY, ECS Fellow, is widely recognized for his scientific activities in electrode kinetics, electrocatalysis, and power sources research, and simultaneously for his outstanding monographs and textbooks. He passed away in Boulder, Colorado (U.S.) on November 12, 2012 at the age of 92. His first monograph *Kinetics of Electrode Processes* (in Russian) was published together with A. N. Frumkin, Z. A. Iofa, and B. N. Kabanov in 1952; and the treatise *Fuel Cells: Problems and Solutions* (the last in his lifetime) was published in 2009. Prof. Bagotsky published that volume and *Fundamentals of Electrochemistry*, 2<sup>nd</sup> ed. (2005), under the auspices of the ECS Monograph Series (published with John A. Wiley & Sons). During this almost 60-years' period, six monographs were published in all, and about 400 journal papers. He continued with the books *Electrochemical Power Sources: Batteries, Fuel Cells, and*

*Supercapacitors and Porous Materials, and Powders: Structural and Wetting Properties and Their Applications* up to the last days, and his Moscow co-authors hope to complete these books soon.

Recently Professor Bagotsky summarized his uniquely long scientific work in a brief article "Fuel Cells, Batteries, and the Development of Electrochemistry" published in the "Electrochemistry – Past, Present, and Future" issue of *J. Solid State Electrochemistry* (Vol. 15, p. 1559, 2011). He mentioned that because he was working simultaneously in the fields of fundamental and applied electrochemistry, he had the opportunity to experience the mutual influence in the development of these two fields. Professor Bagotsky considered electrochemical thermodynamics and electrode kinetics (including macrokinetics and electrocatalysis) as fields that originated from batteries and the emergence of the electrochemical industry, and his personal contribution to all these fields provides an excellent illustration of this statement.



Vladimir Bagotsky's first monograph (left), *Kinetics of Electrode Processes* (1952), and its rarely available NBS translation (middle). A typical illustration from this book (right) is the glass cell with separated compartments, Luggin capillary, and hydrogen reference electrode. It was this type of cells that was used by the Frumkin school to study hydrogen evolution kinetics. The electrical scheme demonstrates how these measurements were arranged in the absence of potentiostats.



Prof. Bagotsky published two of his monographs under the auspices of the ECS Monographs Series: **Fundamentals of Electrochemistry**, 2<sup>nd</sup> ed. (left, 2005) and **Fuel Cells: Problems and Solutions** (right, 2009).

Vladimir Bagotsky was born in Bern (Switzerland) on January 22, 1920, and moved to Moscow in 1938 to enter the Faculty of Chemistry in Moscow State University. Many prominent Russian scientists were still active on the faculty, including Alexander N. Frumkin. Frumkin's Department of Electrochemistry, with its creative atmosphere, was attractive for many young people, and Bagotsky rapidly turned into a true Frumkin colleague just a few years after graduation. He completed his PhD on hydrogen evolution under the supervision

of Prof. Frumkin and Iofa in 1947, and immediately started his independent research. In 1948, he solved (jointly with mathematician Naum N. Meiman) the problem of non-stationary diffusion to the growing spherical electrode, as applied to correction of polarographic currents for mass transport contribution [*Zhurnal Fizicheskoi Khimii*, 22, 1454 and 1466 (1948)], never translated from Russian and unfortunately less known than the papers of the Heyrovsky school. During the short period at Moscow State University, Dr. Bagotsky completed a dozen of experimental papers on hydrogen evolution and oxygen reduction on mercury, the classical model electrode that produced the basis and experience for all precise studies of electrode kinetics at solid materials. Unfortunately, during the odious campaign against "rootless cosmopolitans in science," he was fired from the university, but it appeared to be fortunate for applied electrochemistry.

Between 1949 and 1965, Vladimir Bagotsky worked at the All Union Institute of Power Sources, to develop batteries for aircraft, spacecraft, and submarines. He headed the laboratory dealing with high capacity silver-zinc and mercury-zinc batteries, and jointly—with E. Mendzheritsky, G. Kazakevich, I. Yablokova, and other collaborators—he was recognized as the person who supplied the first Sputnik with power sources. Bagotsky's laboratory was also involved in the work for the first space flight of Yuri Gagarin, and engaged in the development and organization of new battery industries. Later he moved to fuel cell topics, and headed fuel cell development programs in the Soviet Union starting from 1960. As the result of these programs, and with the participation of industry and the Korolev Rocket and Space Corporation, an alkaline fuel cell battery ("Photon") for the space shuttle Buran was developed. These activities also formed the basis for academic research, continued at the Institute of Electrochemistry of the Russian Academy of Sciences (later named the Frumkin Institute) starting in 1965. The basic branches of Bagotsky's fuel cell research were platinum metal electrocatalysis (with Yu. B. Vassiliev), porous electrodes (with Yu. M. Volkovich and I. G. Gurevich), and size effects in electrocatalysis (with A. M. Skundin). Professor Bagotsky headed a strong power sources division at the Institute, consisting of three laboratories and operating with various types of batteries. In the 1980s, he supervised the Russian lithium battery program.

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**Vladimir Sergeevich Bagotsky and Irina Evgenyevna Yablokova**, a unique electrochemical family. They started to work together at the Department of Electrochemistry at Moscow State in 1948, and later continued at the All Union Institute of Power Sources. Batteries for space applications represented their joint success.



*This photo is from the period 1947 to 1949. Pictured are (from left to right, front row): N. B. Moisseeva, A. D. Obrucheva (who was Frumkin's wife during that period, and who was herself very experienced electrochemist), Zinovy A. Ioffa (who supervised Bagotsky's diploma and PhD thesis), and M. A. Gerovich. In the back row, from left to right, are: S. Ya. Mirlina, R. I. Kaganovich, Vladimir Bagotsky, and an unknown person, possibly a lab technician.*



*To celebrate Vladimir Bagotsky's 60<sup>th</sup> birthday in 1980, Yu. M. Povarov (left, who supervised the first lithium group in Prof. Bagotsky's department at the Frumkin Institute), presented Prof. Bagotsky (right) with a small sculpture of "Li" (in his hand), as a symbol of his development of lithium battery research. His co-workers announced that this symbol was fabricated from pure metallic lithium, although it was quite easy to discover that it was actually made of steel!*



In 2000, Prof. Bagotsky and colleagues celebrated his 80<sup>th</sup> birthday. Pictured are some of Prof. Bagotsky's closest colleagues and students. From left to right, are: Alexander Skundin, Alla Mikhailova, Irina Yablokova, Vladimir Bagotsky, and Nina Urisson.



Interested in technology of all sorts, **Prof. Bagotsky** on his tablet at the Society's spring 2012 meeting in Seattle.

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After retirement, Prof. Bagotsky moved to the U.S. and continued his work on monographs, keeping very kind and close contacts with ECS. A special session in his honor—"Professor V. S. Bagotsky – 65 Years in Theoretical Electrochemistry, Electrocatalysis, and Applied Electrochemistry"—was arranged as a part of the 218<sup>th</sup> ECS Meeting (Las Vegas, October 2010). An issue of *ECS Transactions* dedicated to this event was published in 2011 (Vol. 33, No. 32). He never lost contact with his Russian colleagues, who will always remember him as a kind and attentive teacher and friend. Future generations of scientists will learn electrochemistry using Bagotsky's textbook *Fundamentals of Electrochemistry*, and it is difficult to imagine a more solid memorial to any scientist. ■

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