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EDITORIAL

Professor Dr. Algirdas Vaškelis

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In January 2007, Prof. Dr. Algirdas Vaškelis celebrated his 70th birthday. To mark the occasion, several colleagues kindly agreed to dedicate research papers for a special issue of this journal in appreciation of his significant contributions to electrochemistry.

To the electrochemical community, Prof. A. Vaškelis is known as a scientist who successfully fused both fundamental and applied aspects of electrochemistry, electrocatalysis and electroanalysis, thus, achieving a remarkable recognition worldwide due to his contributions to the field.

Born and raised on his parent's farm on a countryside, a small boy and his family were to face and experience severe historical transformations related to the Soviet occupation of Lithuania in 1940, resulting in related awful consequences—repressive deportation of his parents and brother to Siberia, and exile of another brother abroad. Luckily, Algirdas escaped deportation and was hosted by his older sister. However, his so-called "wrong origin" was to have a certain impact over the following years on his life and scientific career.

After graduating from the Chemistry Department of Vilnius University in 1959, he joined the Institute of Chemistry in Vilnius where he received his Ph.D. (1963) and Habilitated Doctor (1982) scientific degree, was appointed as a professor (1985) and the Department Chair (since 1978), later—the Director of the Institute (1992–2001), Academician of the Lithuanian Academy of Sciences (since 1990).

Starting his research career by using, at that time, modern (early 1960s) polarographic technique for studying the reduction of peroxo-anions at sub-zero temperatures, the novel insights to double-layer contribution to multicharge anion reduction were gained. It is worth noting that these polarographic investigations were the first, but not the last, scientific acitivity of Prof. A. Vaškelis. Much later, he and his co-workers applied polarography as a powerful tool for the investigation of transition metal ion complex formation equilibria in alkaline and strongly alkaline solutions, where other techniques were considerably less informative.

The largest part of the research work of Prof. A. Vaškelis, beginning in 1965, is related to the autocatalytic metal ion reduction processes used for electroless metal deposition (electroless plating). He pioneered (independently of M. Paunovic and M. Saito) in adopting a mixed-potential theory (originally proposed by C. Wagner and W. Traud for understanding corrosion processes) for describing the kinetics and mechanism of industrially important electroless metal deposition processes (e.g. fabrication of printed circuits, magnetic storage devices, etc.). Based on this, fundamental insights were gained concerning the "electroless" metal reduction which, in fact, can be described as coupled partial electrochemical reactions occurring simultaneously at the same surface, catalysed by deposited metal. Such interpretation of electroless (self-catalytic) metal deposition is now widely accepted and referred to in numerous textbooks and reviews. To specifically monitor the rates of partial reactions and the kinetics of overall process, Prof. A. Vaškelis and his co-workers enabled the use of on-line electrochemical mass spectrometry and in-situ electrochemical quartz crystal microbalance in various electroless plating systems.

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When investigating the stability of electroless plating solutions, A. Vaškelis carried out a phenomenological study of metal ion reduction in solution volume and made theoretical calculations: Using the classical Gibbs–Thomson equation and the electrochemical model of an autocatalytic metal ion reduction process, he found the critical size of metal nuclei in various electroless plating solutions and an induction period of their growth.

Of more general importance, outside the electroless plating field, is the work by A. Vaškelis in the determination of metal surface area: He pioneered the application of underpotential deposition of metal monolayer for the determination of a real (nano-scale) surface area of metals (silver and copper surface area determination using lead and thallium UPD, respectively).

Prof. A. Vaškelis and his co-workers discovered and introduced a new group of reducing agents for electroless plating of metals—Co(II) amino-complexes and designed novel type solutions for electroless silver and copper deposition. The reduction by Co(II) complexes is characterized by a fairly good solution stability, quite unusual for the reduction with metal ions. The electroless plating processes of new type were shown to have several advantages: high quality metal layers with regular structure were easily obtained, and the reducing agent could be regenerated electrochemically. Some of these novel processes (namely, electroless copper deposition) are already used for industrial applications as environmentally friendly (EDTA and formaldehyde-free) processes. A new type of electroless plating process was introduced based on the extensive studies of chelation of metal ions to complexes. The data on composition and stability of Cu(II), Ag(I) and Co(II) complexes with various ligands were used in the calculation of complex formation equilibria in electroless copper plating systems and the equilibrium potentials for reduction of Cu(II) and oxidation of Co(II) complexes. Based on these calculations, a common potential region for simultaneous occurrence of Cu(II) or Ag(I) reduction and Co(II) oxidation was estimated (a crucial requirement following from the mixed-potential theory) and the conditions (chelating agents, solution pH, additives, etc.) for novel electroless metal deposition processes were successfully predicted.

Prof. A. Vaškelis and his co-workers were pioneers also in the development of a novel type of surface finishing process before electroplating/electroless plating of metals onto dielectric (plastics, ceramics, etc.) materials based on the formation of conducting layer of copper chalcogenes. Such surface finishing is highly economic (Pd-free) and, at the same time, exhibits good adhesion properties of deposited coatings. Thus, this process has attracted the attention of major companies dealing with electroplating/electroless plating processes and is already used by some of them.

In summary, a brilliant scientific career of Prof. A. Vaškelis is an excellent example of fruitful research activities in both fundamental and applied areas of electrochemistry. His work was widely recognized by numerous national and international awards, his inovative contributions are protected by patents, his administrative efforts as the chair of the Department, the director of the Institute, and the academician of the Lithuanian Academy of Sciences has had a high impact for setting the trends and topics for the research in the field of electrochemistry and electrocatalysis, in particular, in Lithuania. In addition, he is the editor-in-chief of the National Journal of Chemistry (Chemija), and a member of the Editorial Board of Russian Journal of Electrochemistry (Elektrokhimiya). He was, and still is, an excellent mentor for a number of former and recent master and Ph.D. students, habilitants who have enjoyed the opportunity to collaborate with Prof. A. Vaškelis and to benefit from his respectful advising, to share his broad knowledge and expertise in literature and arts, and to admire his charming personality.