

Complément à l'article « L'évolution de l'électrochimie : de la pile de Volta aux nanotechnologies », Bernard Trémillon (*L'Act. Chim.*, 2009, 327-328, p. 10).

Annexe - Complete English abstract

Abstract The evolution of electrochemistry: from the Volta cell to nanotechnologies

The invention by Alessandro Volta of the cell which is designed under his name and was known by the scientific community in 1800 has given birth to electrochemistry, the first steps of which overlies almost the whole 19th century. Indeed, for the first time, scientists had at their disposal a lasting source of electric current which allowed considerable progresses in the field of chemistry. An important step in the knowledge in this new area was achieved in 1833 when Michael Faraday laid down his famous quantitative laws and introduced the concept of current conduction into the electrolytes by ion migration. After that, numerous studies about conductivity of electrolytic solutions and ion mobility were achieved, while thermodynamicians attempted to relate the electromotive forces of cells to the heat quantities that they produce. At the end of the century, the concept of electrochemical equilibrium was asserted by Walther Nernst whose the relation bearing his name was published in 1889.

Throughout this century, numerous industrial applications of electrochemistry have emerged: new current-generators more appropriate for applications than the Volta cell, such as the lead battery of Gaston Planté (1859) and the zinc/manganese dioxide cell of Georges Leclanché (1866), electroplating and electrodeposition, more particularly metal electrolytic refining, which all became important industrial activities thanks to the invention of the Gramme machine in 1869. Various electrolytic processes have been industrialized during the 80's, chiefly the Hall-Héroult process for the economical obtaining of aluminum in 1888.

Just after the change of century, the time of modern electrochemistry began, characterized by the theoretical and experimental development of electrochemical kinetics and quantitative analysis of electrode processes, by the birth of analytical electrochemistry which knew a large spreading out after the invention of polarography by Jaroslav Heyrovsky in 1922, at last by the deepening of knowledge about the properties of electrolytes, non-aqueous as well as aqueous, organic as well as inorganic, without omitting molten salts. Miscellaneous specific areas of various names arised during the second half of the 20th century: quantum electrochemistry, photoelectrochemistry, spectroelectrochemistry, electrochemical impedance spectroscopy, solid state electrochemistry, surface-modified electrodes, selective membrane electrodes, etc.

Regarding the applications, they became more diversified compared to those of the beginning of the century, in particular in the field of the electrochemical current-generators and in metallurgy for the struggle against metal corrosion. On the contrary, the application of electrochemical processes in the field of organic synthesis (electrosynthesis), which seemed full of promise during the 60's and 70's, appeared as rather disappointing.

Keywords Electrochemistry, history of science, Volta cell, kinetic, polarography, analytical electrochemistry, electrolytes, applications, batteries.