

In the interest of modern electrochemistry, in particular electroanalysis, are "maintenance free" electrochemical sensors of the metrological parameters that meet the established criteria of validation. They are simple to make and use, and operate with the requirements of green analytical chemistry. Among the basic electrode materials most commonly are used soft metals (Hg, Bi, Ga, In, Pb, Sb, Sn) and their alloys, solid and liquid amalgams, carbon materials (graphite, glassy carbon, diamond doped with boron) and ceramic (nitrides and carbides of transition metals), plastic composites (carbon + adhesive + nanoparticles) and, increasingly, polymers modified by nanomaterials. The signal response of the sensor in contact with the tested sample, typically an aqueous solution, depends on the electrochemical activity, shape and surface area of the electrode, the concentration of the analyte and the type and concentration of interferents. For the sensor to be considered as "maintenance-free" its working electrode(s) must be chemically and physically stable during measurements or be in simple, preferably automatic manner, regenerated between measurements. Thus, design of each sensor requires a detailed diagnosis of the basic characteristics of the measured sample and adaptation of the material used for the electrode, the shape and area of the electrode surface, the use of a suitable receptor - specifically interacting with the analyte or separator of interferents, the procedure of regeneration or activation, and a priori elimination of interferent signal. For the quality of the results post-processing and signals interpretation algorithms are essential. Often, separation of signals is necessary which are derived from different analytes with slightly different reduction / oxidation potentials or which overlap as a result of irreversible thermodynamic processes, or only partially reversible. In this area, it is indispensable to use sophisticated methods of statistical and chemometric analysis. A key element to ensure the required accuracy of the system is the standardization of the sensor in the calibration solutions and proper definition, preferably linear calibration function. At this level multivariate calibration models defined on the basis of the principal component or partial least squares regression, are currently used. The above-mentioned interdisciplinary research projects which interconnects chemistry, physics, materials science, statistics, chemometrics, electronics, information technology and precision mechanics, can bring the effect of smart sensor or at least smart measuring system that meets the requirements of modern analytical chemistry.

The project proposes the development of new electrochemical sensors manufactured from metal, carbon and ceramic functional material, adapted for food analysis and profiling of local foods. Functionalization of electrode sensors ensure their correct operation in an almost "maintenance-free" manner, i.e. using adequate software and environmental samples without or only slightly chemically modified. Analytes, including heavy metals and anthropogenic organic compounds originating from industry, urbanization and widespread "use of chemicals" agriculture will be selected for analysis based on maps of the areas covered by the cultivation of plants and fruits typical for the region. Also local food products will be profiled. The goal of antioxidant determination in food and beverages will be optimization of the conditions of collection and processing of fruits, maintenance and storage of beverages.