Year by year analytical chemistry plays an increasing and substantial role in different areas of human activity. Medical diagnostics, quality control of industrial products, environmental monitoring, research and development - these are just a few disciplines that make intensive use of chemical analysis. Interest in different samples analysis is constantly increasing and it seems that the highest factor that limits access to modern analytical methods is the high cost of purchase and operation of the necessary equipment. This problem has been recognized by researchers many years ago, hence, a lot of effort has been devoted to explore and develop the low-cost alternative analytical methods. The research under this projectis in the range of such works. The project purpose is to determine the analytical performance of miniaturized plasma generated by electric glow discharge operated between a metal electrode (cathode) and the analyzed sample solution (anode), i.e., FLA-APGD (*flowing liquid anode – atmospheric pressure glow discharge*). The property of plasma is that the emitted radiation depends on the type and concentration of atoms of elements present in it. In other words, the wavelength and intensity of the emitted radiation carry information on the type and content of a given element in the sample. This method, called *optical emission spectrometry* (OES) has been used for many years as one of the most valuable analytical tools. A novelty in this project is that, instead of traditionally used large-scale plasma, miniaturized electric discharge, i.e., FLA-APGD, will be used. Large-scale plasmas that are currently the most commonly used, and among them the most popular ICP, are characterized by high consumption of electricity and plasma-forming gas. Moreover, sophisticated and expensive instrumentation is required. The system for generating plasma in FLA-APGD has a much simpler construction and at the same, plasma-forming gas consumption (about 100-300 cm^3/min) and electricity consumption (< 100 W) are by several dozen smaller.

The aim of this project is to develop a discharge system to generate miniaturized plasma operated in FLA-APGD, selection of suitable operating conditions and selection means of analytes introduction in such way that this will provide the highest sensitivity of the method, i.e., that a small number of analyte atoms will generate the highest possible analytical signal. Investigated improvements of the discharge system will concern on the change in liquid anode composition (task no. 3), the way of spectrum collection and acquisition (task no. 4) and the way of sample introduction to plasma (task no. 5). Subsequent research tasks will be focused on the use of FLA-APGD as technique of samples introduction to large-scale plasmas with detection by OES (task no. 6) and mass spectrometry (task no. 7). The effect of the operating conditions of the discharge, i.e., the discharge current, the sample solution and discharge gas flow rates, and composition of the analyzed solution, on the analytical performance, i.e., sensitivity of the analytical lines of elements, linearity ranges of the calibration curves, repeatability, reproducibility and accuracy of measurements and detection limits of elements, will be studied. In addition, to better understand the plasma-chemistry processes occurring in the discharge itself, the values of the selected spectroscopic parameters of FLA-APGD, i.e., gas temperature, excitation temperatures or electron number density, will be measured. In the final stage, to prove the value of the developed analytical methods utilizing miniaturized plasma glow discharge, they will be used in trace analysis of various types of samples, i.e., water, food, environmental samples.