Potentiometric sensors with ion selective membranes allow determination of analyte ions contents in complex samples, typically under open circuit electrochemical equilibrium conditions. Application of these sensors for determination of electrochemically inactive ions under current/ potential trigger of voltammetric/ coulometric conditions offers significant advantages. However, in these applications nature of ion-selective membrane – ion conductor of significant resistance - can be seen as hindrance. As a result both routine application of ion-selective membranes in non-zero current electrochemistry and investigation of the processes occurring in the sensors using only electrochemical approach is a challenging task.

The project proposes introduction of sensitive emission active dyes to the sensors phases, that under condition of electrochemical trigger (current or potential) and resulting reactions will change their optical spectra. Introduction of chromophores to different sensors phases participating in response to electrochemical trigger - signal formation will allow observation of individual processes: redox process of the transducer, ion-exchange on the interfaces, transport and binding of analyte ion in the ion-selective membrane. The important advantage of the proposed approach is possibility of observation, in real time, individual processes affecting overall electrochemical signal. The proposed new research area of spectrofluroelectrochemistry with ion-selective membranes operating under non-zero current conditions will allow simultaneous recording of optical spectra changes. Thus the transduction of electrical signals for emission spectra changes will be achieved. As a result this will lead to better understanding and theoretical description of processes affecting analytical performance of ion-selective sensors operating under electrochemical trigger. Ultimately we aim to develop sensors offering alternative mode of analytical signal harvesting – recording emission spectra not electrical signal, effectively leading to better analytical performance of sensors. The aim of this project is developing a new class of improved ion-selective electrodes – an opto-electrochemcal sensors.