Summary in English

The aim of the research in this doctoral dissertation was to investigate the influence of the structure (arrangement of individual metallic layers) and the architecture (distribution of measurement fields) of the chip on selected analytical parameters of the biomarker determination methods using the SPRi technique. In this work, a new material – Ag/Au chip was introduced, mainly due to the significantly better plasmonic properties of the metallic layer and the lower production cost of the chip compared to the currently used, commercial gold Au chip. In the search for new solutions for chip architecture, three different layer layouts on the biosensor surface were proposed: a chip with a two-layer polymer mask including a blocking mask and a separating mask, a chip with a single-layer polymer mask containing a hydrophobic separating mask, and a chip with a separating foil mask.

In order to check the characteristics of new material, its structure and architecture, a number of biomarker determinations were made on the example of three methods based on biosensors for the determination of cathepsins B, D and S. As reference systems, analogous biosensors formed on a classic commercial gold Au chip were used.

The full characterization of both chips consisted in determining the analytical parameters of the biomarker determination methods by comparing the calibration curves of individual analytical systems, as well as determining the remaining analytical parameters: linear and linear response range of the curves, sensitivity, precision, accuracy, detection and determination limits. The analytical systems for determining cathepsins B, D and S on the gold chip, known and described in the literature, were used as a reference for the research on the newly constructed chip.

In order to verify the correctness of analytical determinations made with the use of biosensors, the design of which was based on the newly defined silver-gold Ag/Au chip, the techniques were validated by determining cathepsins B, D and S in biological samples collected from patients suffering from: endometriosis (cathepsin B), glioblastoma (cathepsin D) and ovarian cancer (cathepsin S).

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