

## Description for the general public

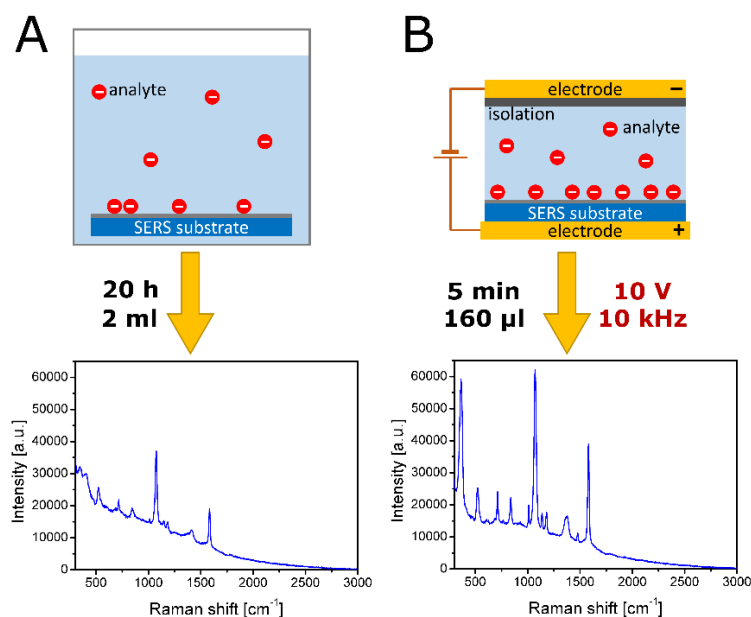
# Development of fast and efficient deposition of analyte in the electric field for improvement of sensing and biosensing

Detection of small amounts of variety of different compounds is pressing need in practically every area in both science and our everyday life. Now it is more urgent than ever. Environmental protection, food industry, medicine, criminology, archeology, basic sciences or molecular biology are just a few examples out of many fields that are in need of new sensitive techniques. Field of science focused on detection and identification of small amounts of matter is called analytical chemistry.

Among great diversity of all methods of detection in analytical chemistry, there is a wide range of detection techniques which are similar in one important aspect: they require proximity of the detected particle (analyte) with sensing surface. In case of these methods, problem of reproducibility of results may occur, causing them to be unreliable. This seems to be connected with non-uniform deposition of analyte onto sensing surface. Therefore, it can be concluded that well-controlled and precise deposition of an analyte is one of the most important aspects of many methods of analytical chemistry. Unfortunately, this issue is often omitted and thus even nowadays very poorly addressed. In presented project we will develop versatile method that will improve deposition process in many analytical techniques.

In our project we want to create a method for fast, efficient and uniform deposition of analyte on different sensing surfaces. Among different analytical techniques we have chosen technique called surface enhanced Raman spectroscopy (SERS) as a test platform. Every molecule has unique fingerprint based on differences in wavelengths between incident and scattered light. In SERS these differences can be measured and thus analytes can be identified. SERS is extremely demanding in respect to proper analyte distribution on the SERS-active substrate. Hence it is perfect platform for developing our method.

Majority of analytes in water solutions have charge. Thus, they can be moved in external electric field towards oppositely charged surface. This phenomena is called electrophoresis and it is main idea used in our project. **We are going to deposit in the electric field different compounds (e.g. proteins, DNA, amino acids) to check versatility of our method. Our preliminary results prove that in case of first tested compound we are able to decrease time of deposition (and thus the whole analysis) from dozens of hours to a few minutes and decrease volume of a sample ten times (Figure 1).** Development of our innovatory idea can improve many analytical techniques and thus makes our lives easier and our world better and safer place.



**Figure 1.** As a preliminary experiment we compared results obtained with (A) typical method and (B) our new approach. Our method is based on electrophoretic deposition of analyte in pulsed-DC electric field. We proved that it is possible to decrease both time and volume of sample and nonetheless obtain two times higher analytical signal.