Printed nanometallic structures for plasmon - enhanced smartphone fluorescence microscopy

Everyone has got at least one smartphone, which has become an everyday use device. Most of us does not realize what are the possibilities of such devices, we focus typically on improved picture quality in the newest telephone, not considering this instrument as a tool for getting reliable information about for instance our health conditions. Nevertheless, it is easy to imagine that the smartphone can be an excellent detector, which upon collecting an image of a droplet of our blood droplet, after appropriate processing, will be able to provide information about our health.

In the project we Focus on fabrication of substrates with printed nanometallic structures with controlled morphology and location. Next, the Surface of nanoparticles will be properly functionalized to facilitate specific attachment of desired molecular targets. Assignment of their presence will be possible by correlating images with the pattern of printed nanostructures..

The method of laser-induced photochemical deposition of printed nanometallic structures has a number of advantages. It does not require advanced apparatus or specific reagents, allows for controlling the morphology and geometry of fabricated structures, it is also fast, cheap and scalable. It is based on reduction of metal salt using laser beam with appropriate wavelength. The nanoparticles exhibit chemically active Surface suitable for functional group attachment, required for obtaining selectivity of detection. Unique benefit of nanometallic structures is related to plasmonic enhancement, which yields strong increase of emission intensity of fluorophores placed in their vicinity.

The ongoing race of smartphone producers results in much better matrixes in available devices. Not long ago typical sizes were 5 Mpix large, today it is possible to purchase a smartphone with 50 Mpix large matrix. In addition, we have access to larger number of acquisition parameters, in particular the acquisition time, in a rather broad range. Majority of smartphone producers also puts a lot of attention for zoom development in cameras, which should remove the need of using any additional lenses.

Justification behind tackling this project is its high universality. On the one hand, we are using devices, which are typically less than a meter from our hand and have substantial detection capabilities. On the other hand, application of printed nanometallic structures may imply that efficient detection will be accessible not only for advanced research equipment.