Portable infrared biochemical sensor enabled by pixelated dielectric metasurfaces

Reporting

Project Information

POCSEL

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Periodic Reporting for period 1 - POCSEL (Portable infrared biochemical sensor enabled by pixelated dielectric metasurfaces)

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Summary of the context and overall objectives of the project

Mid-infrared spectroscopy is considered gold standard in bio-chemical analysis for both research and industry applications, providing chemical specificity, as well as a label-free and non-destructive way of accessing molecular structure on a wide range of samples. Currently available infrared (IR) sensor

techniques rely on bulky and expensive Fourier transform infrared spectrometers or tunable light sources, which severely limits their use in field and practical applications. Therefore, there is a clear need for new optical sensing technologies capable of bringing the power of IR spectroscopy to miniaturized sensor devices at the point of care, which opens new business opportunities. In our ERC Proof of Concept project we investigated realization of a portable spectroscopic biochemical sensor by leveraging our recently invented nanophotonic technology enabled by pixelated dielectric metasurfaces. We studied device implementation in a compact footprint by evaluating various different options for the optical elements (e.g. lenses), optoelectronic components (e.g. light source, detectors), optical trains (e.g. reflection vs. transmission), automated data acquisition and processing. We investigated sensor integration with microfluidics to enable reliable detection of biological samples in their native state. The project also benefitted from our efforts on the low-cost manufacturing of nanophotonic chips with wafer-scale and CMOS-compatible microfabrication techniques and materials. Our results indicate the suitability of the investigated spectroscopic sensor for point-of-care applications.

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