

Label-free nanophotonic biosensors as integrated solution for early and rapid diagnostics

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Photonic biosensors have emerged as a promising alternative for medical diagnostics, offering a versatile technology for rapid and sensitive analysis of biomarkers in a label-free format and integrated in point-of-care (POC) devices. Especially those based on nanoplasmonics and silicon photonics have demonstrated an exceptional potential for tackling current challenges in POC testing, thanks to their unique robustness and reliability, high sensitivity, and simple adaptation to a large variety of targets, including proteins, nucleic acids, cells, or pathogens [1]. Our research aims to provide novel nanophotonic biosensors for clinical diagnostics and biomedical studies. We focus on two main technologies: Surface Plasmon Resonance (SPR) biosensors, and its derivatives in nanoplasmonics, and a pioneering silicon nanophotonic interferometer, the Bimodal Waveguide (BiMW) biosensor. Our work involves the whole process in biosensor production, from design and nanofabrication until the final validation in real clinical scenarios. We have demonstrated successful applications for early cancer diagnostics, gluten-free diet and anticoagulant treatment monitoring, for genomic and epigenomic cell regulation studies, and for infectious pathogen detection. Since March 2020, we are leading a large research project for implementing nanophotonic biosensors as a tool for COVID-19 diagnostics [2]. In this presentation, I will give an overview of our most recent work and the latest advances in photonic biosensor development for SARS-CoV-2 detection. We have implemented three different diagnostic approaches based on (i) direct virus detection; (ii) PCR-free genomic analysis; and (iii) serological assay in order to provide a highly sensitive, specific, and reliable diagnostics of COVID-19 in just a few minutes assay.

REFERENCES

- [1] M. Soler, M.C. Estevez, M. Cardenosa-Rubio, A. Astua, L.M. Lechuga, *ACS Sensors*, 5, 9 (2020), 2663-2678.
- [2] G. Ruiz-Vega, M. Soler, M.C. Estevez, L.M. Lechuga, *Journal of Physics: Photonics*, 3, 1 (2021), 011002.

FIGURES

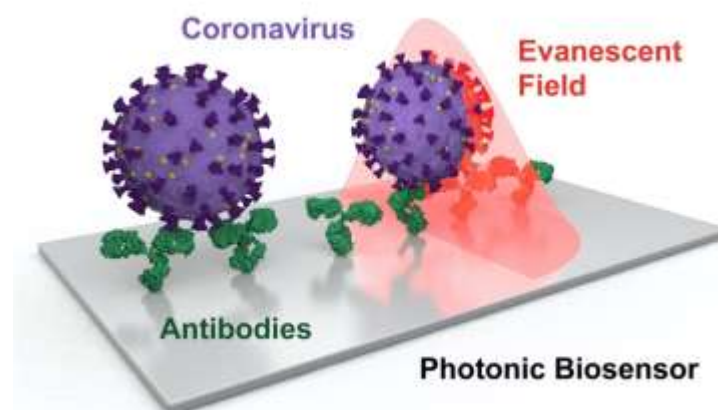


Figure 1: Illustration of evanescent field-based photonic biosensor for direct detection of coronaviruses.