Cortisol in-fiber ultrasensitive plasmonic immunosensing

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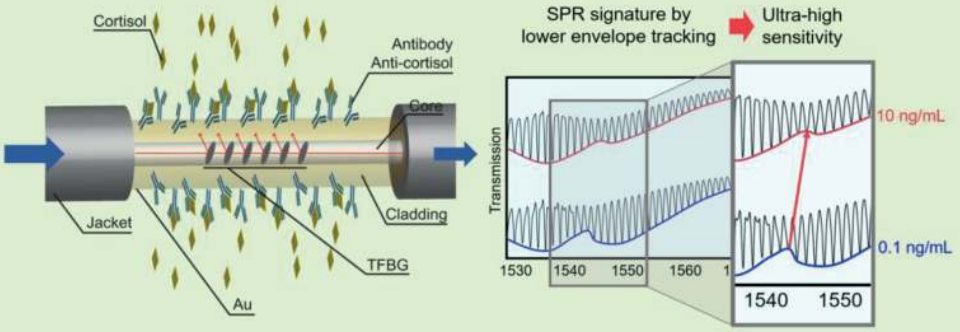
***Abstract*—Cortisol is a stress biomarker whose chronic elevated levels are associated with higher risk of metabolic syndromes, anxiety, and cardiovascular diseases, among other medical conditions. A new immunosensor based on plasmonic tilted fiber Bragg grating (TFBG) has been developed and tested for rapid and ultrasensitive cortisol detection. The gold coated TFBG was characterized to surrounding refractive index (SRI) changes and functionalized with anti-cortisol antibodies via cysteamine. The functionalization was monitored, allowing to verify the SRI alteration at the fiber surface by the respective molecular adhesion. In this work, an alternative method to the monitoring of the most sensitive surface plasmon resonance mode was explored, based on tracking the local maximum of the plasmonic signature of the lower envelope of the spectra. With this interrogation method, the sensor achieved a sensitivity to cortisol detection of 0.275 ± 0.028 nm/ng.mL^{-1}, for the detection range of 0.1-10 ng/mL, with a total wavelength shift of around 3 nm, which is more than an order of magnitude higher than the usually reported TFBG plasmonic immunosensors. The proposed biosensor provides a rapid, highly sensitive, label-free, low-volume consumption method for cortisol detection, with a working range suitable to monitor different biological samples.**



***Index Terms*—Label-free biosensing, lab-on-fiber, optical fiber sensors, SPR tracking methods, stress monitoring, well-being monitoring.**