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Monolithically integrated optoelectronic platform for Point-of-Need application in health & food safety

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Abstract: The biological and chemical optical sensors that are based on integrated waveguides require external active optical components resulting in operational complexity. To overcome these limitations, a radical photonic lab-on-a-chip platform, has been developed comprising planar waveguides self-aligned to VIS-NIR light-sources, and detectors, all monolithically integrated on the same silicon chip and fabricated with standard microelectronic/micromachining processes. The light sources (LEDs) are silicon avalanche diodes biased beyond their breakdown voltage and emitting in the VIS-NIR region of the spectrum. The LEDs are coupled to individually functionalized Broad-Band Mach-Zehnder Interferometric waveguides and the spectral shifts in the transmission spectrum due to the biomolecular adlayers are recorded through either an off-chip spectrometer or an on-chip one. The integrated nature of the basic biosensor scheme and the ability to functionalize each transducer independently with different recognition biomolecules allows for the development of miniaturized optical transducers tailored towards multi-analyte tests. An overview of the fabrication aspects and particular applications for fast and label-free optical immunochemical detection of markers related to human health and food safety will be presented.