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Photonics-enhanced multi-functional labs-on-chips: From lab to fab

Jurgen Van Erps, Heidi Ottevaere, Michael Vervaeke and **Hugo Thienpont**
Vrije Universiteit Brussel, Belgium

Although the development of labs-on-chips has witnessed tremendous progress in recent years, their applications have been limited to singular laboratory prototypes without widespread routine use in clinical or high-throughput applications. Most present-day lab-on-a-chip implementations rely on bulk optical instrumentation external to the microfluidic chip for read-out, monitoring or analysis. This implies that miniaturized portable systems are difficult to realize and there is a large demand for efficient, small and robust optical detection units to create photonics-enhanced labs-on-chips. With the development of polymer-based microfabrication techniques supported by replication technologies such as hot embossing or injection moulding, polymer microfluidic lab-on-a-chip devices hold tremendous opportunities for mass production. This paves the way towards low-cost disposable devices. In addition, polymers offer the advantage of material versatility, since a wide range of polymers is available with characteristics that are in accordance with the requirements for a specific application, such as good optical transparency, biocompatibility, desired chemical or mechanical properties, and suitability for system integration through embedding of components. We show our technology supply chain and our recent progress in the design, fabrication and proof-of-concept demonstration of integrated miniaturized photonics-enhanced biosensors for absorbance and fluorescence measurements as well as Raman spectroscopy. All systems combine high sensitivity with a relatively simple layout to ensure their manufacturability and robustness. In addition, the units can be reconfigured for sensing various molecules at different wavelengths paving the way towards multi-functional, low-cost, portable, robust, and, ultimately, disposable lab-on-a-chip systems that can be used in the field and for point-of-care diagnostic applications.

Biography

Jürgen Van Erps completed his PhD in 2008 from the Vrije Universiteit Brussel (VUB), Belgium, and Post-doctoral studies from the University of Sydney, Australia. Since 2013, he is a Professor at VUB. He authored or co-authored 41 SCI-stated papers and more than 90 papers in international conference proceedings. He is co-inventor of 3 patents. He serves as a reviewer for several international journals. He is a senior member of the SPIE, and member of the OSA and the IEEE Photonics Society.

jverps@b-phot.org