Photonic Lab-on-a-Chip: Integration of Optical Spectroscopy in Microfluidic Systems

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Photonic lab-on-a-chip analytical systems (PhLoCs) are considered the unique integration of photonic systems with microfluidics. In this seminar, we will discuss the main principles that have paved the PhLoC development, and specially for the on-chip spectrophotometric detection.

The synergistic combination of photonic integrated circuits (PICs) with LoC gives rise to the photonic lab-on-a-chip (PhLoC) concept [1], Therein, the main function of microfluidics is the manipulation and transport of the analytes, while the PICs transduce the (bio)chemical signal arising from the analytes in situ to a quantifiable signal. In this context, the implementation of a PhLoC has to be based firstly on the selection of the appropriate detection mechanism, i.e., colorimetry [2], fluorimetry [3], scattering [4] or plasmonics [5], and secondly, the design of the PhLoC, considering both the optical properties of the materials and the geometry of the optical elements. In this presentation, either monolithic [6] and modular (figure 1) [7] PhLoC concepts will be discussed.

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FIGURES

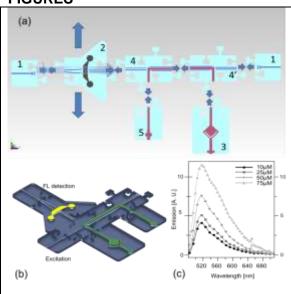


Figure 5. (a) Design-scheme of the modular optofluidic system (MOPS) used in this work. The individual modules are: 1) Two fiber optics connections, 2) a solid/liquid absorbance filter (filled with a colorant or a doped sol-gel) which can be included or excluded as required, 3) a fluidic inlet port with an internal air bubble based pressure regulator, 4/4') two waveguides directed to a microchannel which is shielded with air mirrors to prevent optical cross-talk, 5) a fluidic outlet port; (b) 90° configuration for fluorescence measurements; (c) Emission spectra of aqueous Fluorescein solutions with different concentrations. Figures published at [7] and reproduced by permission of The Royal Society of Chemistry.