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Noninvasive Characterization of Glucose Aqueous Solutions based on Continuous-wave Photoacoustic Techniques and First Generation of Phantom cell.

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Over the last few years, we developed two complementary protocols based on continuous wave photoacoustic (CW-PA) technique and dedicated to the noninvasive and continuous monitoring of blood glucose levels (BGLs) [1]. After obtaining promising results *in vitro* with bulk system, we reported last year first *in vivo* measurements that validated the basic concept [2]. However, the gap between *in vitro* and *in vivo* remained huge and difficult to cross at once. As an intermediate step toward the *in vivo* condition, we then proposed the 1st generation of phantom cell, a microfluidic chip made of PMMA which can handle and confine the liquid sample while optical fiber and acoustic sensor placed outside the cell do the characterization (Fig. 1). This phantom can then replace the ear-lobe of *in vivo* testing while providing good control of the sample solution composition (diluted compounds as well as their respective concentrations) and the dimensions. Furthermore, this phantom, despite its basic structure, provides several advantages including fast and low-cost prototyping and flexibility in the design. It also enables a drastic increase in number of experiments per day due to small sample volume.

First set of measurements were dedicated to assess the effect of any misalignment or any pressure change on the acoustic sensor. Both parameters have some effect on the acoustic response of the cell, but did not interfere with the measurements as long as they are kept constant during the all measurement sequence.

Then, systematic measurements of aqueous glucose solutions were performed with various cell sizes and at different frequencies. Despite still on-going, the experimental results revealed very different trends than previous ones obtained from the bulk system, which will in turn enable us to get a better understanding of potential issues we may face when dealing with *in vivo* testing.

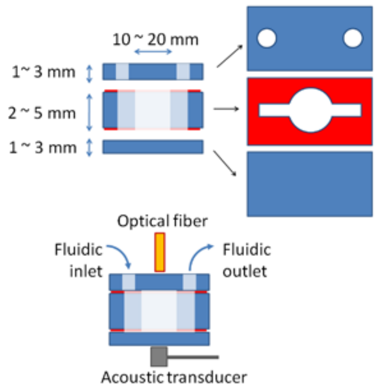

Fig. 1 Schematic view of the proposed fabrication process based on patterning of acrylic plates (in blue) with CO2 laser cutting tool and bonding with double-side tapes (in red).

[1] S. Camou et al., chapter in "Pervasive and Mobile sensing and computing for healthcare", ISBN 978-3-642-32538-0

[2] S. Camou et al., in proceedings of IEEE Sensor, 2012, Taiwan.