MONITORING OF METABOLIC PARAMETERS OF MAMMAL CELLS CULTURES IN MICROFLUIDIC DEVICES USING INTEGRATED OPTICAL CHEMICAL SENSORS

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Optical chemical sensors are well established in the chemical industry, life science, biotechnology and research laboratories. They are operate non-invasive, do not need any reference elements and can be read-out via contactless measurement. Moreover, it is possible to miniaturize and integrate them into microfluidic systems. Due to their simple composition, optical sensors can be produced at low price and therefore represent a good alternative compared to electrochemical sensors for their application in disposable microfluidics.
The various possibilities of integrated optical oxygen sensors have already shown their potential in different microfluidic applications [1]. However, monitoring of further metabolic parameters is important for a better understanding of biological processes. Therefore, our group develops, next to oxygen sensors, also optical sensors for monitoring pH, glucose, CO_2, ammonia and various ions. Still, integration in a Lab-on-a-chip format is a challenging task due to the state-of-the-art performances in terms of signal brightness, response times, optoelectronic read-out systems, fabrication and integration.

Here we want to present integrated optical oxygen and pH sensors with miniaturized sensor read-out instruments, which are capable of monitoring mammal cell cultures in flow-through microfluidic devices. In future, these microsystems will be used for medium and high throughput toxicity testing. Potential interaction of toxic substances is altering the metabolic response of the cell cultures, which results in changes of the pH and oxygen levels.

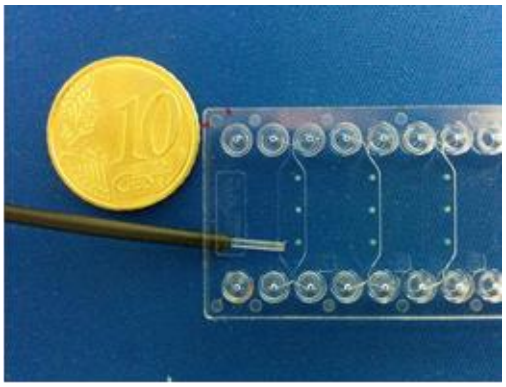

Figure 1: O_2 sensor spots in microfluidic channels with fiber-optic read-out

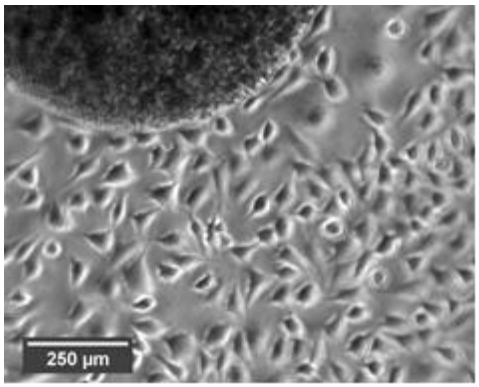

Figure 2: Transmitted light microscope images of L929 (mouse fibroblastic cell line) after 72h incubation with an pH sensor spot

References:
[1] Rennert, K. et al. Biomaterials 2015, 71, 119 – 131