Prof. Marcel Utz

~ University of Southampton ~

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Salle Marie Curie

Integration of nuclear magnetic resonance with microfluidic devices - opportunities and challenges

Nuclear magnetic resonance is one of the most versatile experimental techniques available. Among other talents, it is ideally suited to the analysis of complex mixtures. It is non-invasive, and can therefore be used to follow metabolic processes in living systems without interference, at great quantitative accuracy, and in real time. Our research has recently focused on integrating NMR with microfluidic lab-on-a-chip devices. In particular, we are interested in developing perfusion systems for tissue slices, cell cultures, and small organisms. Integration of microfluidic systems with NMR spectroscopy is challenging because of the small sample volumes. Careful optimisation of the NMR detectors in order to maximise sensitivity is required to address this. Moreover, sensitivity enhancements offered by hyperpolarisation techniques show great potential in this context, in particular, if the necessary spin manipulations and chemical steps can likewise be integrated into the microfluidic system. In this presentation, I will illustrate these challenges and some possible solutions with examples of microfluidic NMR systems, including tissue slice perfusion, cell cultures, as well as emerging applications in supramolecular chemistry.

Biographical Sketch

Marcel obtained his PhD in polymer science and physical chemistry at ETH Zürich in 1998. After a postdoc at Princeton University, he joined the faculty of the Institute of Materials Science at the University of Connecticut in 2000. His work at that time focused on solid state NMR, amorphous solids and other complex materials. In 2006, he moved to the Department of Mechanical and Aerospace Engineering at the University of Virginia, where he was introduced to microfluidic lab-on-a-chip technology by a colleague. Since 2012, Marcel is at the University of Southampton, where he currently acts as head of the Magnetic Resonance research section in the School of Chemistry.

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