DTU Health Tech
Department of Health Technology

Raman spectroscopy in microfluidics

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Raman spectroscopy in microfluidics (Moritz Matthiae)

Abstract

Raman spectroscopy allows the identification of molecules and crystalline solids by their fingerprint-like, vibrational signature. This work contributes to three fields of applied Raman spectroscopy: Raman blood analysis, Spatially Offset Raman Spectroscopy (SORS) in microfluidics and Raman scattering in nanostructured dielectric metasurfaces.

A microfluidic plasma fractionation scheme in whole blood flow is developed in this work which allows the optical inspection of instantaneously created blood plasma. The combination of this microfluidic chip with Raman spectroscopy is suitable for accelerated free hemoglobin quantification on whole blood at clinically relevant concentrations of hemolysis. These results are peer-reviewed and published in Analyst 144, 602-610 (2019).

Furthermore, the liquid in the microfluidic channel and the PDMS chip material are by design a two-layer system where the methodology of SORS can be applied. An alignment protocol is proposed in this thesis which allows consistent alignment of Raman optics with respect to the microfluidic chip for quantitative Raman concentration measurements of analyte in the microfluidic channel. These results are peer-reviewed and published in Optics Express 27(3), 3782-3790 (2019).

Nanostructured dielectric metasurfaces are rich in optical properties. They show for example Mie-type resonances in the visible and near-infrared part of the optical spectrum. Here the effect of such resonances on the enhanced Raman scattered intensity is investigated.

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