

COLLOQUIUM

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13:00 – 13:45

The Meeting Room, Building 108
Optics and Plasma Research Department
Risø National Laboratory
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Interferometric Nanosensing

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Abstract

On-chip interferometric detection (OCIBD) has recently been shown to allow measurement of optical path length changes on-chip, facilitating RI determinations at the level of 10^{-7} within detection volumes of 40 picoliters. OCIBD has been shown to be useful for universal solute detection in on-chip CE, for picoliter-scale thermometry and to quantify flow rates non-invasively on-chip. In general, this unique and simple optical train affords high sensitivity, universal solute detection within probe volumes over large ranges (μL - pL), while circumventing many of the limitations of conventional detection schemes. OCIBD can be done on isotropically etched chips as well as on molded plastic chips and has facilitated the quantification of proteins such as Lysozyme, Cytochrome C, BSA and Egg Albumin at the level of 1.5-7.0 μM (0.1-10 femtomole) with separation efficiencies from 105,000 to 500,000 plates/m by on-chip CE. It is also now possible to perform non-invasive temperature measurements at a resolution $1.0 \times 10^{-3} \text{ }^\circ\text{C}$ within a 47 pL detection volume, on-chip. Using this technique to directly evaluate temperature evolution during Joule heating in electrophoresis has allowed a better understanding on how temperature perturbations influence separation efficiency in on-chip CE. Recently the 10^{-7} barrier has been broken so that changes in η (RI) to less than four parts in 10^{-8} at 3σ can be quantified. At this level proteins are quantifiable at the sub-micromolar level. Using a two capillary embodiment it has now been possible to compensate for large temperature gradients (ca. 5°C) with RI resolving power equaling $2 \times 10^{-9} \Delta n$. Finally, using various immobilization techniques on PDMS chips, label-free protein binding, reversible protein-protein binding and DNA binding assays have been performed with detection limits at the attomole level. The utility of performing interferometry for nanoscale thermometry, calorimetry and label-free molecular interaction assays will be presented.

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