Sensitive layers for optical biosensors and protein chips

The goal of this thesis was the development of sensitive surfaces for optical affinity biosensors detecting in complex biological media. The practical application of these surface-based technologies has been hampered by protein fouling from biological media, in particular blood plasma, where the vast majority of relevant analytes are present. The work of the thesis was centred in three main foci:

- Design and preparation of antifouling and non-fouling surfaces
- Evaluation and conceptualisation of their resistance to fouling from blood plasma and serum as well as other biological fluids
- Preparation of sensitive layers for detection in complex biological media

Three approaches were used to prepare protein resistance surfaces, i) ω-functional self-assembled monolayers (SAM), ii) end-tethered polymers and iii) polymer brushes prepared by surface initiated controlled radical polymerisation. Investigation of proteins in the blood plasma deposits on PEG- based surfaces revealed that some fouling is unavoidable in PEG-based surface modifications. A novel type of non-fouling polymer brushes based on poly[*N*-(2-hydroxypropyl) methacrylamide] challenged the accepted ideas for the design of protein resistant surfaces.

For the first time a label-free optical affinity biosensor was successfully applied to diagnosis in real clinical samples.

Keywords: affinity biosensors, blood plasma fouling, polymer brushes, atom transfer radical polymerization.