



Aston University

Engineering & Applied Science

Rigorous, Relevant Research

Biosensors

► Introduction

Proteomics demands sufficiently sensitive analytical tools to probe the structure, function, behaviour and molecular interactions of peptides and proteins. Biomedical applications also require fast and high performance biosensors to detect bacteria for diagnosing diseases, such as TB, AIDS, malaria, etc. Advanced optical biosensor technologies offer several major advantages, including fast detection of non-specific labelling of the interacting species, real-time and dynamic analyses and ultra-high sensitivity. The Photonics Research Group at Aston University has initiated a highly multidisciplinary project – Advanced Photonic/Nano Biosensor Devices, Systems and Applications. This project brings together the knowledge, expertise and skill from photonics/nano fabrication, bio-materials and bio-molecular science. The aim is to develop novel, in-fibre-probe and lab-on-chip bio sensitive/selective devices and systems with versatile applicability for fast, sensitive and real-time detection of very small biochemical samples. They can also dynamically analyse protein/protein, protein/DNA and cellular interactions. The primary technology focuses of the project are as follows:

- The integration of photonic and nano fabrications to create micro/nano and fluidic structures in optical fibres and planar waveguide substrates functioning as generic sensor platforms;
- The development of bio sensitive/selective/compatible materials and immobilisation techniques for the bioactivation of photonic/nano sensor devices.

These key technologies will enable the highly focussed production of biosensors for end-point applications in biomedical devices for studying molecular interactions in cells, tissues and whole organisms with potential applications in genomics, proteomics and drug discovery R&D, as well as in food quality control and environmental monitoring.

► Sponsors and funders

- EPSRC.

► Academic partners

This highly multidisciplinary project involves partners from four research groups across two schools (SEAS & LHS) at Aston University and also in collaboration with the Turku Biomaterials Centre of Turun Biomateriaalikeskus, Finland.

- Professor Lin Zhang and Professor Ian Bennion (Photonics);
- Professor Geoff Tansley and Professor Peter Brett (Biomedical Engineering);
- Professor Brian Tighe and Dr Andy Sutherland (Biomaterials and Biomolecular Science);
- Professor Peter Lambert and Dr Anna Hine (Cellular and Clinical Neurophysiology);
- Professor Heimo Ylanen and Dr Reeta Viitala (Turku Biomaterials Centre, Finland).

► Key projects

- Advanced Photonic/Nano Biosensor Devices, Systems and Applications.

► Recent publications

- Zhang L, Zhang W and Bennion I, "In-fibre grating optic sensors" Fibre Optic Sensors, Second Edition, ed. Yin S, Ruffin PB, Yu FTS, Dekker M, New York, 2008, pp. 109-162.
- Bennion I and Zhang L, "Recent advances in fibre grating based optical biosensor" Invited paper to the International Conference on Optical Fiber Communications (OFC-2006), OFF3, Anaheim, California, March 2006.
- Chen X, Zhang L, Zhou K, Davies E, Sugden K, Bennion I, Hughes M and Hine A, "Real-time detection of DNA interactions with long-period fiber grating based biosensor" Opt. Lett., Vol. 32 (17), Sep. 2007, pp 2541-2543.
- Zhou K, Lai Y, Chen X, Sugden K, Zhang L and Bennion I, "A refractometer based on a micro-slot in a fiber Bragg grating formed by chemically assisted femtosecond laser processing" Opt. Express Vol. 15, 2007, pp 15848-15853.
- Chen X, Zhou K, Zhang L, and Bennion I, "Dual-peak long-period fiber gratings with enhanced refractive index sensitivity by finely tailored mode dispersion that uses the light cladding etching technique", Appl. Opt., 46 (4), Feb. 2007, pp. 451-455.

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