



Contribution ID: 755  
 compétition)

Type: **Oral (Student, In Competition) / Orale (Étudiant(e), inscrit à la**

## Protein Biosensing with Fluorescent-Core Microcapillaries

*Tuesday, 16 June 2015 16:45 (15 minutes)*

Whispering gallery modes (WGMs) are the electromagnetic resonances of dielectric spheres, cylinders, or rings. The WGM wavelengths can shift when the resonant field interacts with a local analyte fluid. This work demonstrates a fluorescent core microcapillary that utilizes WGMs for biosensing applications. This device consists of a glass microcapillary with a 50- $\mu\text{m}$ -diameter inner channel. The channel wall is coated with a film composed of fluorescent silicon quantum dots (SiQDs). Because the SiQD film has a higher index of refraction than the glass capillary wall, it can support cylindrical WGMs. The QD fluorescence spectrum thus consists of a set of sharp peaks at the WGM resonance wavelengths. Part of the WGM field extends into the capillary channel where it samples the fluids pumped inside; thus the cavity resonance wavelengths in the QD fluorescence spectrum depend on the channel medium. The sensitivity of the WGM wavelengths varied between 3 and 24 nm per refractive index unit, depending on the SiQD film thickness. Biosensing with this device was then demonstrated using the standard biotin-avidin system. The QD film in the capillary channel was coated with alternating charged polyelectrolyte (PE) layers with exposed amines for attaching biotin. Biotin in turn has a high specific affinity for the neutravidin protein. These biotinylated PE layers were found to capture neutravidin, yielding a detection limit of 6 nM and an equilibrium association constant of  $1.1 \times 10^6 \text{ M}^{-1}$  for biotin-neutravidin in this sensor. Several "blank" runs indicate minimal nonspecific binding. Attractive features of this device include a high degree of physical robustness and minimal equipment requirements (e.g., a tuneable laser is not needed to scan the cavity modes). Future work will aim to increase the so-far moderate detection limit, potentially by improving the device sensitivity via finer control over the SiQD film thickness.

**Primary author:** Mr LANE, Stephen (University of Alberta)

**Co-authors:** Prof. MELDRUM, Al (University of Alberta); Dr FRANCOIS, Alexandre (University of Adelaide); Mr WEST, Peter (University of British Columbia)

**Presenter:** Mr LANE, Stephen (University of Alberta)

**Session Classification:** T3-1 Materials characterization: electrical, optical, thermal (DCMMP) / Caractérisation des matériaux: électrique, optique, thermique (DPMCM)

**Track Classification:** Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)