Contribution ID: **1509** Type: **Poster (Student, Not in Competition) / Affiche (Étudiant(e), pas dans la compétition)**

ZMW Nanopore Fabrication by Controlled Breakdown for Single-Molecule Sensing

Tuesday 14 June 2016 19:22 (2 minutes)

The last decade has seen significant advancements in nanofluidic devices to study transport processes at the single-molecule level. In particular, exciting results have been obtained through the study of passage of nucleic acids through solid-state nanopores (ssNP). ssNP are nanometer-sized holes in thin dielectric membranes, which have emerged as a versatile tool to investigate a wide range of phenomena involving DNA and proteins. Controlled breakdown (CBD) is a technique for fabricating such ssNP involving sustained high electric fields that was recently developed by our group as a low-cost, high-yield alternative to traditional focused ion-beam/TEM drilling methods. We have characterized the ability of CBD to create pores in substrates of increasing complexity. Devices incorporating different materials and advanced functionalization represent a crucial step toward refining the capabilities of ssNP as single-molecule sensors of electrophoretically-driven biomolecules, and increasing their range of potential applications. To this end, we demonstrate pore fabrication by CBD through multilayer dielectric membranes equipped with an embedded metal electrode. A thin gold layer was deposited on 10/30 nm SiNx membranes by thermal evaporation, followed by the addition of a second dielectric (HfO2) to both sides using atomic layer deposition. After pore fabrication, conductance-based models are used to extract an effective nanopore diameter, which can be compared to values obtained from TEM imaging and by using passing, voltage-driven DNA as a molecular-sized ruler through its effect on ionic current. Applied to these membranes, the CBD process resulted in structures consisting of a nanopore surrounded by a concentric area of removed metal 100s of nm in diameter. By using laser-excited Ca2+ fluorescent dyes, the ability of these structures to act as zero-mode waveguides, attenuating the fluorescence signal away from the pore and enabling high-contrast optical detection of single-molecules, can be characterized.

Author: Mr ROELEN, Zachary (University of Ottawa)

Co-author: Dr TABARD-COSSA, Vincent (University of Ottawa)

Presenter: Mr ROELEN, Zachary (University of Ottawa)

Session Classification: DPMB Poster session, with beer / Session d'affiches DPMB, avec bière

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)