Trapping DNA using Metalized Nanopores

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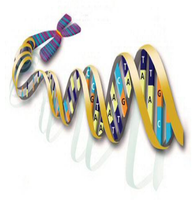
Introduction

Inexpensive DNA sequencing using metalized nanopores has the potential to be the next great breakthrough in medicine. The possibility to rapidly and inexpensively sequence the genetic information of the majority of the population could open the door to personalized medicine. In this poster the process of drilling and metallizing the pore are explained along with analysis of the results.



Objective

One of the problems with the current configuration:

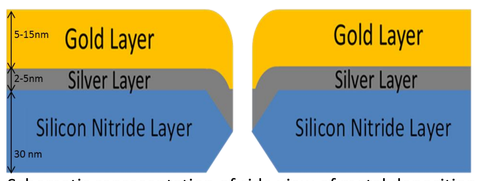
Rate of Translocation.

- Slow down DNA strand passage through nanopore by chemical and electrical manipulation of the membrane layer using Gold and Silver.
- Expected result is the capacity to achieve a translocation rate with lower bandwidth requirement.

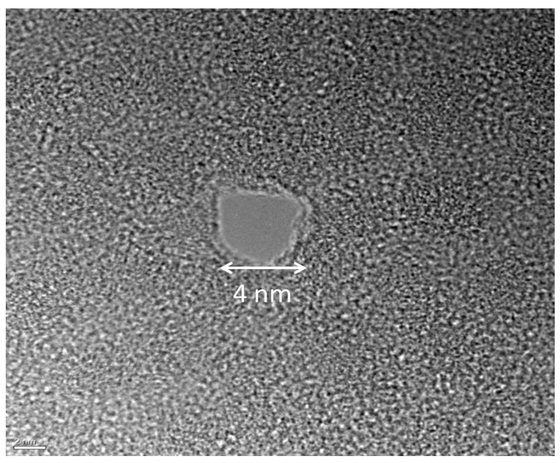
Methods

Drilling the Nanopore

Nanopores are drilled on a 3x3mm silicon nitride chip of Norcada company using a 300kv Transmission Electron Microscope (TEM) from FEI company. The electron beam is focused on the sample and it can create pores of any size required.



Schematic representation of side view of metal deposition.



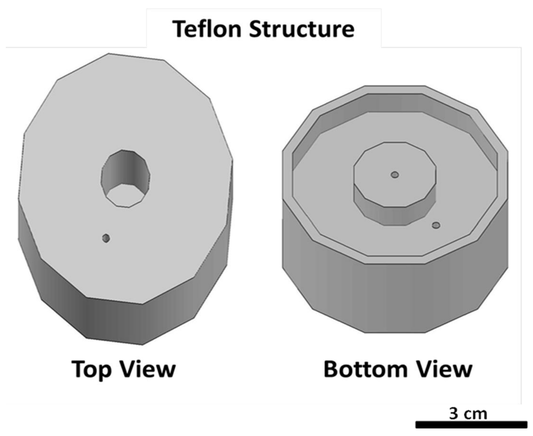
Nanopore on Silicon Nitride chip at 690kx
Chip has a 30nm thickness and a free-standing Silicon window of 50x50 µm.

Metalizing the Nanopore

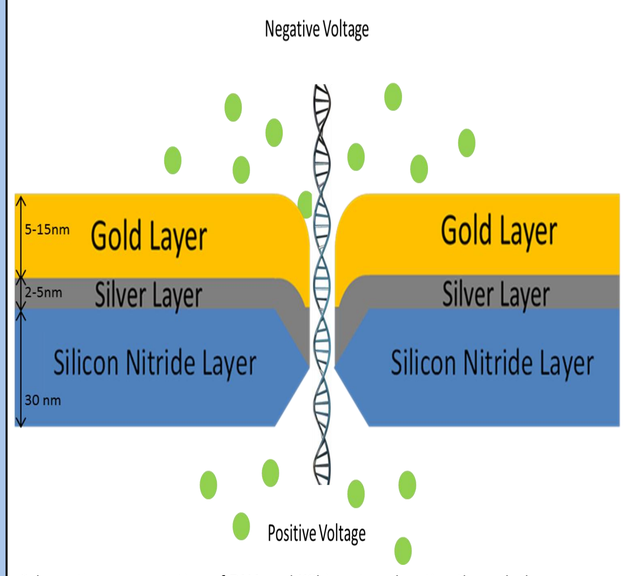
To metalize the nanopore an Ion Beam Evaporator device was used to deposit a Silver layer and a Gold layer above the Silicon Nitride layer leaving the nanopore open and available for DNA to pass through.

Teflon Structure

Once the Silicon Nitride chip has been metalized and is ready to be tested for DNA translocation, it is set up on a Teflon structure such that it separates two reservoirs of electrolyte solution. Leaving the Nanopore as the only connection between them.



Analysis

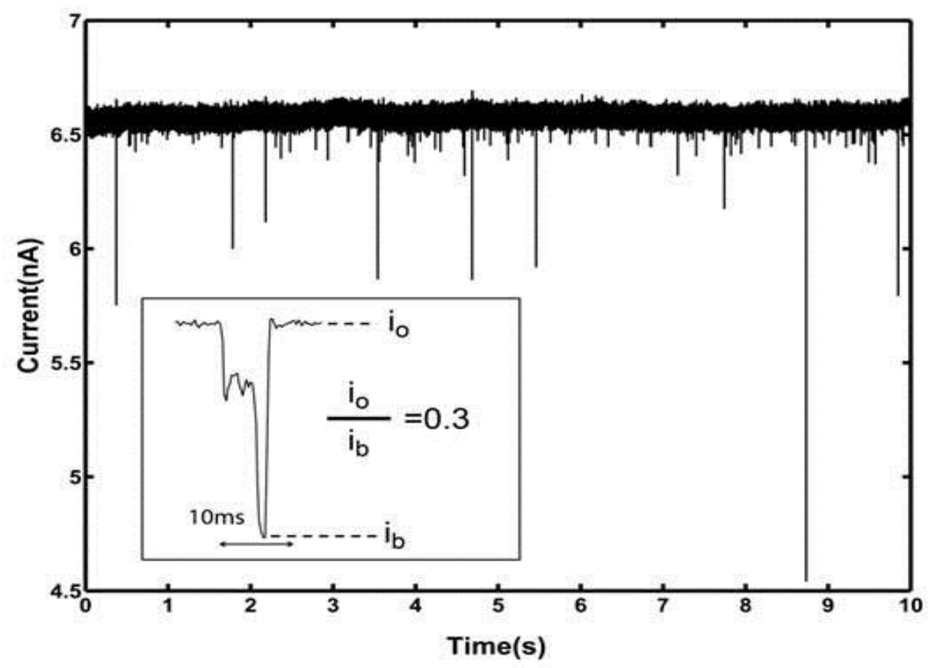


Schematic representation of DNA and KCl ions translocating through the metalized nanopore.

The DNA molecule has a negative charge and when a difference of potential is applied within the reservoirs it translocates through the nanopore. This creates a blockage of the ions. This translocation can be registered as a drop in ion flow through the pore and measured as a current drop.

Preliminary Results

Applying a difference of potential to two reservoirs of KCL, we can measure a baseline current across the nanopore. The graph below is current vs. time across the nanopore. The baseline current of the ions is at approx. 6.6nA and the sudden drop in current represents the DNA translocating through the nanopore and blocking the ions (current).



Current vs. Time of 1Mol KCl solution across a metallized Nanopore at 300mv potential.

Conclusion

Translocation has been observed, however as of now we have not observed translocation rate reduction. Further experiments are underway and different membrane configurations including thickness of metals and diameter of pore will be implemented and tested.

Acknowledgments

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