EE 491 WEEKLY REPORT 7 ***Date: 10/18/16-10/24/16***

Group number: 1721

Project title: Glucose detection using a disposable nanosensor

Client &/Advisor: Prof. Que

Team Members/Role: Shir Linn Tan (Team Leader)

Wai Han Kong (Team Communication Leader)

Dalton Strauser (Team Key concept holder)

XiongSheng Yi (Team Webmaster)

- **Weekly Summary**

  For the seventh week, our group did the third presentation named "CNT thin film sensor". When we done presenting the 3rd presentation, our professor informed us that we will be fabricating this thin film sensor for our project and thus the reason for us to study this paper. He said that when he or his PhD student is back from the conference, we would be able to go to MRC and get some stuff done, since we need a experienced lab adviser in order to be inside the MRC lab.

- **Past week accomplishments**
  - Shir Linn Tan: Preparing the notes and summary for the third presentation. Task with the part of explaining the results during presentation.
  - Wai Han Kong: Help Shir Linn Tan with the summary of the third research paper. Task with the part of a more detailed explanation regarding the result and also giving a final conclusion of the whole research paper.
  - Dalton Strauser: Compile the summary into slides form. Task with how the carbon nanotube thin film works and how we could manufacture it.
  - XiongSheng Yi: Edit and summarize the slides into a shorter presentation. Task with the introduction and giving the pros of using the CNT thin film compared to other technology and other material.

- **Pending issues**
    - Shi Linn Tan: Study up additional information on the CNT thin film which we study for the last research paper.
    - Wai Han Kong: Study up additional information on the CNT thin film which we study for the last research paper.
    - Dalton Strauser: Study up additional information on the CNT thin film which we study for the last research paper.
    - XiongSheng Yi: Study up additional information on the CNT thin film which we study for the last research paper.

- **Individual contributions**

NAME	Individual Contributions	Hours this week	HOURS cumulative
Tan Shir Linn	Preparing the notes and summary for the third presentation	4	17
Wai Han Kong	Help Shir Linn Tan with the summary of the third research paper	4	16
Dalton Strauser	Compile the summary into slides form	4	15
XiongSheng Yi	Edit and summarize the slides into a shorter presentation	4	15

- **Comments and extended discussion**

The past presentation prove to be very meaningful for our group as we finally learnt what method of manufacturing and what we would use for our project itself. We would be doing CNT thin film for our glucose detector. Aside from that, from what we had learnt during the research of this CNT film, we get to know that the initial process of manufacturing this CNT thin film is quite similar to what we had done in the semiconductor fabrication lab, as such we would be more confident about it unlike the past few week where we had no idea what would be doing at all.

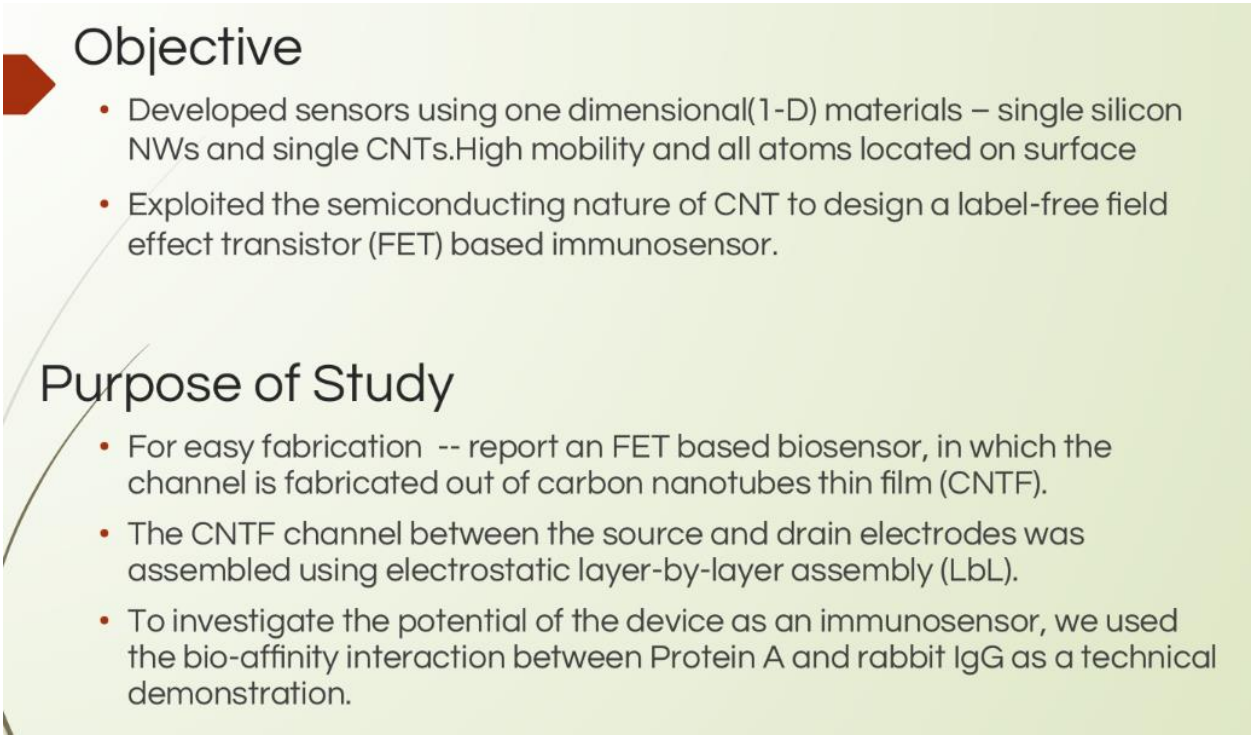
Since the professor is busy and such, we had plan to go and visit his PhD research student soon and get more information as to what we would be doing and what to expect from this. For now we would just study up the process ourselves.

- **Plan for coming week**
  - Shir Linn Tan: Study up on CNT thin film
  - Wai Han Kong: Study up on CNT thin film
  - Dalton Strauser: Study up on CNT thin film
  - XiongSheng Yi: Study up on CNT thin film

- **Summary of weekly advisor meeting**

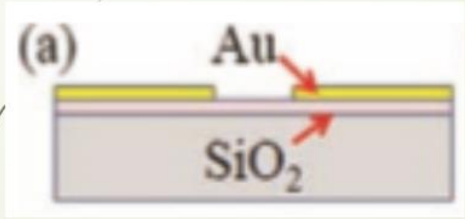
For the last week, we prepared and presented our 3rd presentation for Professor Que. We managed to get a confirmation on what we would be using for the glucose detection itself and also the method of producing it. Then, we would fix a schedule to collaborate with Dr.Que PhD student and get involve in the experiment regarding this project when they are back from the conference according to Professor Que himself. We expect that starting from the moment they are back from the conference, we would finally be able to get some work done on the table instead of just studying stuff.

I had included some important slide that are related to what we are going to do in the time to come and also some manufacturing process and how to use it.



Fabrication of FET

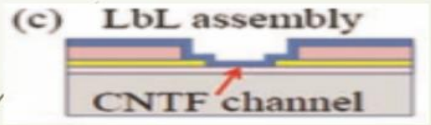
- Fabrication process -- combining optical microlithography and electrostatic LBL self-assembly process. Additional fluidic channel can be integrated with type II device.

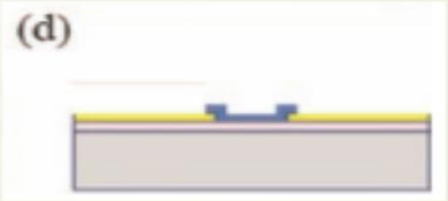


Fabrication Process

1. Used a 100 mm, p-type <100> silicon wafer with a 200 nm thick layer of thermally grown oxide.
2. First, the gold source and drain electrodes for both types of devices were fabricated using a bilayer metal lift-off process.
3. Using the same process, fabricate the Al gate electrode for type I device.

Fabrication Process Continue





4. Patterned the channel between the source and drain using photoresist.
5. For the LbL assembly, PDDA and PSS solution in DI water. Then added 0.5M NaCl to improve ionic strength. (then continue with lots of fabrication process)
6. At the end, etch away the unwanted CNTF layer and then rinsed with IPA and DI water.
7. Final produce of assemble the CNTF channel in between the source and drain for type II device.

Conclusion

- The FET based biosensor was fabricated using a combination of photolithography and Layer-by-Layer self-assembly.
- Device characterization confirmed that the fabricated device behaves like a p-type transistor
- Experiments done to investigate the response of the device to Protein A-IgG interaction indicated that the device could detect IgG concentrations that are as low as 1 pg/mL.
  - Drain current variation in response to various IgG concentrations
  - Average drain current values changes for different concentrations of IgG