

International Training Program
Netherlands University of Twente MESA+

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As the long-term placement program of International Training Program (ITP), I studied another research in Prof.Dr.ir. Albert van den Berg group in Twente university of Netherlands for 60 days from 10th January 2010 to 20th March 2010. This paper is my report of these days in Netherlands.

In Netherlands, I belonged to the Prof.Dr.ir. Albert van den Berg group of Twentw university for 2 months to study the new filed related the bio. While I stayed in Netherlands, Prof.Dr.ir. Albert van den Berg group, Dr. Edwin T. Carlen, Ph. D, Ph. D student and technicians helped me to concentrate on my research in Netherlands. I would like to say “Thank you very much for your kind” to the member of laboratory.

The experience that I visited at Enschede city in Netherlands was very good for me. Because everything is first experience for me. For example, I used the new experimental equipment, learned new knowledge and stayed there alone in Europe for 2 months. It is significant for Ph. D student and life in future to have this experience. I did not get the new knowledge but also the chance to grow up as a person in this program. I had a good experience that I studied my research in laboratory and had a communication with the people of laboratory and the local people in Netherlands, live at the location which I do not know, contact the different culture. I think that these experiences are very important things in the long-term placement program of ITP.

When I stayed at Netherlands I could contact the culture of Netherlands and Europe. I always thought everything in Netherlands. Especially, I felt the

difference clearly between Japanese life style and European life style. They try to make time that they have a break time or do their hobby. We have the break times in morning (from 10:30 to 11:00) and afternoon (from 15:00 to 15:30). We stay at the coffee room with coffee and talk everything such as culture, football, movies and customs each other during the break times.

Most of Netherlands people go to super market to buy the bread, ham and cheese. After that they make the sandwich from foodstuff. Of cause, there is café in university. However they do not go to there to eat something. Because it is expensive to eat the food in café. When I go to the café with my friends, I did not feel so that. They go to the super market to buy foodstuff and make sandwich from foodstuff. It is cheaper than they go to the café. That is why they are sparing person.

When I went to Netherlands first time, I had a problem every times. The first week I arrived at Netherlands, a serious cold wave were attacked Europe which was the strongest recently. Our flight from Japan to Netherlands was very delay due to heavy snow. I could not reach to Enschede. So I had to stay hotel around airport. Next day, I took the train directly from airport (schipol) to Enschede. Suddenly the train was canceled because of snow. So I had to transfer many train. Finally it was possible to go to Twente University safely by cooperating among Japanese students each other though it had a hard time understanding what situation at that time because the announcement in the car was only Netherlandish. It is felt that it was also good that the town named

Enschede was able to cooperate in the ITP temporary staff because the Japanese is few, and there are only several Japanese students of the level also at the Twente university each other. After I arrived Enschede, we could get to the student dormitory by the special managements of Dr.Edwin and people of laboratory. and registered about the room. The procedure of the apartment was helped, and the shopping center in the vicinity of the university was guided for life. It is really indebted to the people in the laboratory in the stay destination also excluding this.

Introduction of Enschede and Twente University

There is the location that it takes 2 hours to get to the Enschede from Schipol airport, it is closed to Germany. The population of Enschede is 150 thousands. It prospered from the Middle Ages to the 20th beginning of the century as cotton textiles. There is Twente university between Enschede and Hengelo (this city is next to Enschede.) It takes about 10 min to get to university from station. Around university, there are region richly endowed with nature and is lake and river. There are wild birds in the lake. I thought the university is at one with nature. Twente university is found in 1961. Every building has a traditional atmosphere (Fig. 1). However they are making new building. On this May, they will move to new building. As for MESA +, MESA + was established as a

nanotechnology laboratory where MESA had amalgamated MESA (MicroElectronics,Sensors and Actuators) with CMO(Center for materials research) in 1999. The researcher from a different field has gathered because MESA + is thought that a new thing arises in gathering the researcher in all fields, and uniting their knowledge. Moreover, it is provided with the clean room equipped full as facilities (Fig.2).

The continent of my research

First of all, what I had had to do was to have understood by what understanding of this research and policy to advance the research. Moreover, it was similarly important as had the learning of the use of the device to the first stage. The thesis concerning some researches was read for these understanding, and the use of the device was taught from Yusuf that experimented on both. " Selective Surface Functionalization of Silicon Nanowires via Nanoscale Joule Heating, Inkyu Park, Zhiyong Li, Albert P. Pisano, and R. Stanley Williams, NANO LETTERS, 2007 Vol. 7, No. 10 3106-3111" etc. Discernment concerning the helicon wave plasma was able to be deepened by reading these theses.

Recently, there have been great interest and aggressive development in silicon nanowire (SiNW). It are applied for many application including sensor for the detection of solution pH level, protein, gas



Fig. 1 Appearance in building with laboratory



Fig. 2 Appearance of clean room

molecules, DNA, cancer markers, and neuron signals. However a SiNW itself does not have the function to detect some target for analyses. However SiNW does not have chemical specificity toward analytes. To detect certain target species, the surface of SiNW have to be functionalized with proper probe molecules that can interact with the target species to be detected. Moreover selective functionalization of a SiNW array will be great important to render SiNW sensor versatile and practical. It can potentially improve the sensitivity and detection limit of the sensor by functionalizing SiNW. However it is problem to attach the probe to all SiNW on substrate. In this case, there is probe on all SiNW. Therefore external noise can not be cancelled. There are two SiNW on substrate (Fig. 1). One SiNW has DNA probe. On the other hand, another SiNW does not have it. Each probe is obtained the information such as molecules, pH, temperature, electric noise. However one probe can not be obtained molecules because SiNW does not have probe to detect molecules. An example of our differential measurement is shown in Fig. 1, where I_s is the current measured from the SiNW with probes and I_r is the current measured from the reference sensor without probes. The currents are measured and magnitude for the difference $|I_s - I_r|$ contains the information about the molecular hybridization. To detect the molecules, it is necessary to attach the probe to one probe.

However it is difficult to attach only one probe. The proposed method is to use a thin gelatin that can be selectively dissolved using modest heating ($P=I^2R$) from one of the nanowire devices. The gelatin is first

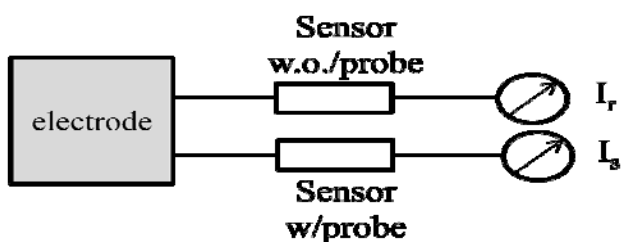


Fig. 3 Schematic diagram of SiNW

spin-cast on the substrate and thermally cured. A microfluidic flow cell is then bonded to the Si-NW substrate and de-ionized water (dH_2O) is then introduced to the channel and the Si-NW is used as a heater by applying a voltage. The heating will cause the gelatin to dissolve in the water and is subsequently removed with a rinsing step.

There is a key point to which this experiment is made to succeed. It is uniting the probe only in one of SiNW as for the probe molecule. First of all, to unite the probe molecule only with one of SiNW, the film of about many hundreds of nm is formed on SiNW. Only the upper part of one of SiNW removes the thin film after it forms, and the probe molecules are united. And, the probe molecule unites only with one by removing the remaining film, and the one of SiNW alone that does not unite anything can be made for the other. It is necessary to achieve two targets roughly separately to make this state. ” 1. The thin film of about many hundreds of nm is made on SiNW.” “2. The film is partially removed.”

It succeeded in making the thin film of about 200 nm on SiNW when the thin film was made on the substrate with SiNW. However, only one of SiNW should remove the thin film after this in this time. The method makes the voltage impressed to SiNW, makes SiNW heated, and removes a surrounding thin film.

In this program, I did not use in Japanese at all. It was very good for me. Because I was not good at speaking English. But in this time I maybe improve my English very much. I continued to use in ordinary conversation, questions and answer, discussion, etc. so In the English education in Japan, reading and writing are focused on, and speaking and listening are shortage. That is why I could improve it. As mentioned above, I am able to apply to my Ph.D. project in the future and Japan-Netherlands international communication through the research about carbon and the

communication with the group members. Hence, the two-month stay in Netherlands got the invaluable treasure for me. I was allowed to experience being not able the experience of it in case of being in not only knowledge concerning the experiment but also Japan.

We want to express our gratitude to the people at the stay indebted while the Netherlands is staying destination again.

Finally, I deeply appropriate professors in Nagoya University and Ruhr University and staffs in Nagoya University who managed ITP.