

Report on Visit to Sungkyunkwan University by International Training Program

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1. Introduction

Recently the development of technology in Asia is outstanding. In Nagoya University they invite many foreign students and communicate actively in the Professor's level. With these academic communications, more and more development for education, experiment in the university and co work between university and company is expected.

I report this paper for my experiment I joined "International Training Program (ITP)" powered by incorporated administrative agency Japan Society for Promotion of Science from December 3, 2009 to January 31, 2010 and did a research in Sungkyunkwan University in Korea.

2. About SKKU

Sungkyunkwan University is one of the oldest private university which has a history for more than 600 years from its establishment as a school for Confucianism. It has two campus one is in Seoul for department of humanitie, art and gymnastic course and the other is in Swan, located in around 35 km south form Seoul city, for science course respectively.

In the program I joined Professor Han's laboratory in CAPST(Center for Advanced Plasma Surface Technology) in Swan campus. At there we could see the cutting-edge experiment of plasma application and experiment directly those experiment.

3. About experiment

1) Back ground

Recently larger capacity and high speck for Ultra-Large Scale Integrated Circuits (ULSD) is demanded because of increase of information handing amount and highly-complicated function of it. To satisfy it Miniaturization and integration of element multi-stratified



CAPST is located in this building

Interconnection is proceeded. For Miniaturization, the lithography technology to etch the pattern on the tip more and more short wavelength light source is needed. Processes until now is satisfied with the combination of ArF light source (193nm) and "liquid immersion" technology. However from 22nm process it is very hard to apply with that technology, and EU light source (13.5nm) is focused as the light source technology for next generation.

2) Objective

Because of the short length the resist have to be thin the depth of focus have to beshallow. So during etching process high selectivity and precise control is demanded. In this research etching control with EUV resist is focused. However enough selectivity is not be able to gain with plasma with conventional gas. In this reserch I focused on etchinf with CH_2F_2 plasma.

High selectivity can be gained with CH_2F_2 plasma because of polimerization on resist under Si_3N_4 etching condition. However plasma condition have to be controled to control ratio of polimerization because if polimerization is too strong change of mask pattern shape is getting bigger.

3) Experiment

High selectivity etching was done with dual-frequency capacitively coupled plasma equipment. Si₃N₄ film coated wafer is set on bottom electrode. In dual-frequency capacitively coupled plasma equipment high frequency power, 60MHz, and low frequency 2MHz can be input at the same time. With controlling high frequency power plasma production, ion and radical flux to the sample etc., can be controlled. With controlling low frequency power ion movement, ion energy etc., can be controlled. With changing these power we can control the plasma condition. The result of experiment is omitted.

4) Learning from this experiment

Through this experiment life for two months in Korea I could improve my motivation as a researcher and broaden my sight. Especially I was so surprised for high motivation of Korean students. In Korea more students study not only Master course but also Doctor course compare to Japan. And they had high motivation to study English and Japanese.

I communicated with Korean in English, but at the first time I asked to speak again and again. They have Korean accent in their English. But I got to use it through daily communication. I felt English is used around the world but every country has their own dialect. Like getting used to Japanese dialect we can get to use English dialect. I felt we have to have experiment in real life.

I also get more deeper understanding of my major field and wide knowledge through the experiment which is different from what I do in Japan.

I want to improve by learning from others with a view of not only inside of our country but also worldwide and want to contribute to society as one of top researcher in this field with international view gained from this program.

With looking back the experiment life in Korea I thought I had prepared more before I came to Korea because it took almost 3 weeks to prepare to start the experiment in Korea. If I had searched more about laboratory in CAPST and studied my research background, I can get into the research more smoothly and I could have

experience more.

4. About life

1) Life in the laboratory

The daily life in the laboratory is very productive time. Korean students in the laboratory are really kind and they tried to talk to us actively and helped us. They took us to lunch and dinner to many places. Sometimes they took us to billiard after dinner. In Korea billiard is very popular in public. Around the station there are so many billiard stores like convenience store in every city. Most of billiard table doesn't have a pocket and do the game named as "4 ball". Every student in the lab is good at billiard.

And they also took us to drink. Korean likes distilled spirit named as "Soju" very much and drink a lot. They click their classes each other every time they drink, and they were really comfortable.



Members of laboratory



Billiard is popular with Korean



They took me to drinking a lot.

Experience of the position to be taken into laboratory, opposite to daily life, I could feel the nervous and counting on for the foreign student. But the anxiety was disappeared quickly because member of laboratory was very kind to us. They took care of us a lot and tried to talk to me a lot. They took care of not only closed friend but also all members of laboratory students. I couldn't take care of foreign student in my own laboratory not only to let him enjoy Japanese culture but also try to talk actively. From now on I will communicate with foreign student and develop my International communication skills.

2) Life in guesthouse

Han professor prepared guesthouse for staying. It is really comfortable because home appliance was perfectly setted like from shower to randry, refrigerator and TV. I didn't use during this stay but I could cook by my self because there is kitchen, too. Especially heter of floor is very thankful in badly cold tempreture in Korea. In Korea everywhere you go, house or restaurant, you can see floor heater. This is from "Yondoru".

3) Sightseeing

In the weekend I enjoyed sightseeing in Seoul. We can see Japanese bords in "Myondon" and "Tondemumon", center city of Seoul city, and we don't have to take care Korean language during shopping because a lot of salse person can speak Japanese fluently I was taken to several historical places like Deoksugung and Gyeongbokgung. Korean royal palace uses really showy color but it looked really beautiful. I could enjoy to



Room I stayed for 2 month

listen to detail story like historical background with Japanese guide.

Every Korean food is really delicious and i looked forward that every day. Price is really reasonable, from 400¥ to 700¥, and you can eat BBQ less than 1000¥. But it supposed hard for the people who hate spicy hood for Korean life because most of Korean hood is spicy.

4) Culture of Korea

Through this program I could have the experiment which I cannot have through sightseeing with communicate with natives.

Korean culture impressed me specially was respect and attention for seniors. For example in the drinking party every students get in the restaurant around 30min before and at the time professor come they stand up and welcome the Professor. The way of communication is based on Confucianism. I felt there are many points of manner we have to learn.



They use scissors in the meal

5. In the end

With this experiment I could rethink about the way to be researcher. There are many things we have to learn from Korean students like motivation for research, passion to study foreign language, attention for coworkers and so on.

I also get more deeper understanding of my major field and wide knowledge through the experiment which tama is different from what I do in Japan.

I also I could make many Korean friends. Especially the association with researchers who studies same field will be the precious fortune for my researcher life from now on.

In the end I wanted to appreciate to Professor Han and CAPST members and ITP affiliates to give me this opportunity. I will make use of the experiment and knowledge which I get from this ITP program for my future work as a researcher.



“Kyonbokun” is famous in Japan from drama