

Report on Visit to Sungkyunkwan University by International Training Program

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I participated in International Training Program (ITP) and researched for about two months from 12th January until 13th March, 2009 in Sungkyunkwan University in Korea, now I will report about that as follows.

Sungkyunkwan University and the laboratory to which I was sent

Sungkyunkwan University is a private university established in 1398 and one of the universities have the oldest history in Korea. The university has two campuses, one in Seoul and another in Suwon. There are faculties of humanities, athletic and art course at Seoul campus, faculties of science or engineering course at Suwon campus. Suwon campus is located to 35 km south from Seoul; it takes about one hour to the campus from Seoul by subway. I was assigned to Prof. Han's laboratory named CAPST (Center for Advanced Plasma Surface Technology) at Suwon campus. In CAPST, state-of-the-art researches of the plasma application technology were done, and I obtained a chance to penetrate those researches.

Research theme and working scheme

As a result of the discussion, a research theme was decided in Korea. Each student of CAPST did presentation of the each research for about ten minutes before the research theme was decided. The research theme was decided from the stay beginning in two weeks, and my research theme was 'making Si thin film apply to the solar cell with a hybrid system'. My co-worker was doctor's student Mr. KyungSik Shin. A meeting was held in CAPST once a week. Prof. Han told me to make an English presentation about the research theme and the working scheme by the next meeting. And then Mr. Shin gave me a lecture about the research work, I understood the research. Afterwards, I made a research plan with Mr. Shin and then I reported about a topic of my

research and my working scheme in English for about 15 minutes.

Table. The working scheme

Poly-silicon process using ICP-assisted facing target sputtering		1			2			3		
Objective	Process	2/12-17	3/18-24	4/28-31	1/2-7	2/8-14	3/16-21	4/23-28	1/2-7	
This film synthesis [4" FTS system]	Study (Review & state of art)	→								
	Energy & Flux control									
	- ICP power									
	- RF									
Analysis	H ₂ dilution									
	- Ar & H ₂ mixture									
	Raman spectroscopy									
	FT-IR									

Before researching

I researched about the mass spectrometry with plasmas in Japan. My research work in Korea was a little different from it. I had never experienced plasma process. So I studied a mechanism of the vacuum, how to vacuum, a principle of magnetron sputtering, and state-of-the-art before the research work was started. I read the paper "Mechanism of Hydrogenated Microcrystal line Si Film Deposition by Magnetron Sputtering Employing a Si Target and H₂/Ar Gas Mixture" K Fukaya et al, Japanese Journal of Applied Physics, volume: 48, Issue: 3, 2009, my co-worker gave me the paper. In the case of that I couldn't understand about the paper, I read "Sputter Deposition" written by William D, or asked Mr. Shin, and tried to understand the outline of the research.

Research work

1) Research background

Magnetron Sputtering is very beneficial compared with PECVD. One of the reasons is that it's not expensive. It doesn't need the rigorous safety system. Second reason is that it's not toxic process. It doesn't need to use highly toxic gases like phosphine or diborane. And third reason is that it is possible to deposit films without substrate heating through the energy control of species in the plasma.

2) Research objective

The objective of my research work is to make high quality

Si thin films for thin film solar cell by hybrid system. High quality means high deposition rate, high crystallinity, and no defect.

c-Si has lower bandgap than a-Si. So the adsorption wavelength of c-Si is larger than that of a-Si. And, in the case of c-Si, the light-induced degradation is very little. So we should make c-Si thin film for thin film solar cell.

3) Experiments

I will omit a detailed content of the experiments by co-worker's intention.

4) Learning through the research

It made an impact to my life as a researcher in the future that I researched the field a little different from that in Japan for two months. I think that my view of research extended more than before I came to Korea by experiencing a state-of-the-art technology. I felt the power of "Trying for the time being" and "Doing positively" through ITP program. I think that I was able to widen my view by challenging ITP program though I had not experienced plasma process. Perhaps, I think that I was not able to have such a wonderful experience if I thought ITP research was different from the research in Japan and did not try ITP program. Moreover, I was not confident of English. I think that I made my co-worker trouble. I think that I was not able to obtain anything if I didn't try speaking English. We can learn anything and grow up with curiosities and ambitions even if the culture and land are different or not, we can speak English or not, the research is different or not. I think that this is a favor that the people related to ITP give us young researchers the chances to grow up. I try to take advantage of the experience and the knowledge obtained through ITP program to my research in the future, and I want to make an effort to repay the kindness to the society.

Next, I want to report about my life expect the research work.

Life as a researcher

I was working on the research after having decided the research theme as shown in the following tables.

Table. Life schedule during a day

9:00 ~ 10:00	Going to the laboratory
↓	Literature research (Self-study)
12:00	
↓	Lunch
13:00	
↓	Work in the laboratory
18:00	
↓	Dinner
19:00	
↓	Work, Discussion with co-worker
21:00 ~ 22:00	Going home

The professor, the researchers, and all students attended a meeting held at 9 or 10 AM on every Monday. Each of doctor's students reported about each research every week. In the case of master's students, they reported about their research every second week. All meetings were held in English while we stayed there. I also reported about my research in English twice.

All students including me did not need to go to the laboratory on weekend and holiday. But some students went to the laboratory and experimented on weekend. I also went to the laboratory on weekend when the co-worker experimented.

Accommodation

I stayed at the university's guesthouse prepared for the foreign researchers for two months. The guesthouse was located next to the university. It took 10 minutes to the laboratory, and 5 minutes to a round-the-clock convenience store from the guesthouse on foot. There was no obstacle in life because it was equipped fully with a television, a washing machine, a refrigerator, kitchen (cooking utensil, table wares, dishwashing liquids, and sponges, etc.), a shower room, a rest room, a cleaner, a electric jar, an iron, shampoos, soaps, and towels, and a telephone. I could call on campus only. And I could use the internet at the guesthouse.



Meal

In the guesthouse, I had bread, fruits, and vegetables I bought at the supermarket or the convenience store for breakfast. I had lunch with CAPST students at the university cafeteria. The lunch price was very cheap, about 100–300 yen. And then I used the cafeteria and the restaurants outside the university for dinner. The dinner price at the restaurants was a little higher than the university cafeteria, and the price was about 300–700 yen. Korean food was cheaper than Japanese, but it was hard to me to eat Korean food because of a spicy taste. Moreover, I could not eat at the cafeteria and the restaurants without Korean students helping because there was no English, Japanese menu, and nobody was able to speak English or Japanese there.

CAPST students

There were four doctor's students, four master's students, and one undergraduate student in CAPST (including a international student, and except for students taking leave of absence in February, 2009). Korean guys have military service (for 2–3 years) with the difference from Japan and Korean students went to study to foreign countries for learning English were not few. So, even the same grade, Korean students were senior to Japanese students by 2–4 years. And there were a housewife and a student who returned the university after working. So, I thought that the width of the age of the student was wider than that of Japan.

I thought that the language level of Korean students was higher than that of Japanese students. People who can speak neither English nor Japanese will not get a rise in their salary in Korea, so Korean students seemed to make efforts to the language study. And the English texts used in the class because the specialized books were not translated into the

mother tongue unlike Japan. I thought that Korean students' resistance to English was less than Japanese student's case. Most CAPST students mastered the English language at pretty much an everyday conversation level.

The student's impression was an impression that they had ambitions and was very ardently to their research, polite, and people of virtue. I respected them very much as the same student and I was glad to meet them.

Other experiences

1) Sightseeing

On weekend, I went sightseeing in Seoul, and near by the university. In Seoul, I enjoyed shopping and watching non verbal shows. In Suwon, I went to Hwaseong Fortress. It is one of world heritages.



Figure. Hwaseong Fortress

And it was so large; I watched it by bus as follows.



Figure. Sightseeing bus

And I went to Folk village in Suwon. I could learn Korean history and culture there.

2) Learning Korean language

In the first month of the stay life, I was interested in Korean language, and I began to study Korean language. Because the character was simple, it took short time to remember all

Hangul. The arrangement of the subject and the verb also looks like Japanese, and I think that it is a language Japanese people study easily. However, Korean has ten kinds of vowels, and understanding the pronunciation was difficult to me. I communicated with the Korean students smoother than before studying Korean, fortunately. I think that one of the reasons was that I could understand Korean a little. They might notice that I was interested in Korean, so they might become interested in my culture. That was second reason.

At the end

I could learn a lot through ITP program. I want to take advantage of the experience and the knowledge obtained through ITP program to my life as a researcher in the future. I wish sincerely to express my gratitude to every staff related to ITP who gave me such a chance, every member of CAPST, and two students who worked hard for the research with me.