Report on Visit to Sungkyunkwan University by International Training Program

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I have visited to Sungkyunkwan University in Center for Advance Plasma Surface Technology (CAPST) by International Training Program from January 13, 2009 to March 13. The long-term dispatch by International Training Program for 2 months in Korea is the great experience in my life. I have a positive influence on the future form this International Training Program in Korea. I am sure that International Training Program is great program.

Sungkyunkwan University is the top class in Korea. It is sponsored by SAMSUNG. In addition, it has two campuses in Seoul and Suwon. There is the campus in Seoul for humanities course such as economics, literature, and law school. There is the campus in Suwon for science course such as mathematics, chemistry, and physics. Then, I dispatched t o Sungkyunkwan University in Suwon.

Main study in CAPST is SiOx film for barrier, Si films for flexible solar cell using magnetron sputtering, plasma enhanced chemical vapor deposition (PECVD) and hybrid process (sputtering and inductive coupling plasma (ICP)). And. they are fundamental understanding on film nucleation and growth by plasma diagnostics such as Laser induced fluorescence (LIF), Optical Emission Spectroscopy (OES) and relationship between plasma parameters and film structure or corresponding properties.

Before vitiating to Sungkyunkwan University my theme in Korea was not decided. At first, all students in CAPST gave presentation for knowing their work in CAPST. After that, I discussed with professor Han in English about ‘what I will do for 2 months’ .Finally, I decided what I will do for 2 months in Korea.

My theme was synthesis of Micro crystalline Silicon (μc-Si) film by PECVD. I have worked with Mr. Youn J. Kim who is Ph. D. candidate student in CAPST.

The project of this study started in January, 2009. Before starting this study with Youn J. Kim for 2 months, we discussed the plan of this work in English. As a result, we had the experimental plan about changing parameter such as input power, mixing ratio, working pressure, electrode distance for optimized processing and for evaluations film quality using Raman spectroscopy. In addition, we created a plan for plasma diagnosis using intensified charge couple device (ICCD) camera. .ICCD camera can detect low-intensity light we can get high-resolution spectrum using ICCD camera. This is useful tool for OES. I made a presentation about plan for International Training Program in weekly meeting in English.

I have worked for synthesis of Micro crystalline Silicon (μc-Si) film by PECVD using RF power of 13.56MHz for solar cell. I have worked with Mr. Youn J. Kim who is Ph. D. candidate student in CAPST. He is excellence for plasma and μc-Si film. And we always did the best for this study.

In this study, the plasma source was coactively coupled plasma (CCP) using RF power of 13.56MHz. The anode electrode was a shower head of diameter in 220mm. The glass substrate was set on cathode electrode. The glass substrate temperature was controlled by heater. The shower head electrode was cooled by water for restraining increasing the temperature .Processing gases was SiH_4 and H_2.Mixes SiH_4 and H_2 was introduced to the chamber form the shower head electrode. The processing parameter such as input power, mixing ratio, working pressure, electrode distance was changed for optimization of synthesis of μc-Si film. For evaluations film quality, Raman spectroscopy and FT-IR was used. For plasma diagnosis, OES was used in this study.

μc-Si film is components of crystalline silicon and amorphous silicon. Many researchers have been studied Si film for solar cell to solve environment problem in the earth for long time.. There are 3 type of solar cell. They are crystalline silicon, amorphous silicon s and microcrystalline solar cell. They are crystalline silicon, amorphous silicon s and microcrystalline solar cell. Crystalline silicon solar cell has high efficiency. But, from 200μm to 300 μm in thickness

of crystalline silicon is required for solar cell because of low optical absorption. Therefore, they are high cost. And amorphous silicon solar cells have high optical absorption and cost is low. The thickness of this film isn't required for solar film like crystalline silicon. But, the problem of this film is low efficiency microcrystalline silicon has high efficiency. And it is low cost using by PECVD.

But, 2μm in thickness of microcrystalline silicon film is required for thin film solar cells because of low optical absorption. Therefore, high deposition processing is required for microcrystalline silicon film. For increasing efficiency, highly crystalline is required. And high rate deposition and low temperature processing is required for low cost, the purpose of this study is synthesis of high rate and highly microcrystalline silicon at low temperature processing.

My theme in Japan is atmospheric pressure plasma. But, our theme in CAPST is synthesis of μc-Si film by PECVD for solar cell. This theme is different from my study in Japan. I read a lot of paper for understanding background in mc-Si film. And I discussed our experiment with Mr. Kim in English. In addition, I made a presentation for what I did for 2 month in Korea at meeting in the closing days of International Training Program. These experiences was valuable to improve my English skill, I realized improving of my English skill through these experience. I was interested in another filed such as μc-Si film.

Every day I went to CAPST in Research Center 1 at 9:00 and came back to the guest house where I have stayed for 2 moths in Korea during 21:00 from 20:00.All the students of CAPST were very kind, did the best for their work. I was always help by them for everything.

In CAPST, we have regular weekly meetings on Monday from 9:00. They gave their report about what they did in last week and what they will do in this week. They discussed their work with Pro Han in English. During the meeting, they always spoke in English. I learned a lot of thing from this meeting. The most impression in weekly the meeting was what Pro Han said. He said to us that your work is just chasseing reference. Your work is done long years ago by someone. You are engineer or scientist. You are not worker. You have to work for new idea. Why don't you try new thing or concept? What he said is thought-provoking thing for us.

I attended the seminar by Dr. Nikolay Britun who is Postdoctoral fellow in CAPST twice. He is professional for plasma diagnosis. Especially, He knows a lot of things for LIF. He worked for magnetron sputtering by using LIF. The topics of seminar were LIF and Fabry-Perot interferometer (FPI). Atomic or molecular species have quantized energy state. The species excited by the absorption of the photon emit the light called the fluorescence. A laser radiation which has the wavelength adjusted equal to the difference in energies between lower state and upper state is used. By measuring the LIF intensity, we estimate the concentration of the species in lower state. FPI is typically made of a transparent plate with two reflecting surfaces, or two parallel highly reflecting mirrors. We can estimate velocity distribution in magnetron sputtering by using FPI. I am very interested in plasma diagnosis. This seminar is very useful for me. His presentation is very good. This is easy-to-understand for me because of his comprehensive knowledge of LIF and FPI.

I have stayed in the guest house near Sungkyunkwan University for two months. There is necessary for life such as refrigerator, television, vacuum cleaner, washing machine, rice cooker, a restroom, shower, kitchen in the gusset house. The distance from the guest house to Sungkyunkwan University is only five-minute walk. It is very close. In addition, there are big dormitories for student of Sungkyunkwan University. Around Sungkyunkwan University. A lot of students live here

Three dispatcher in Korea have stayed in one room. We can use desk for each person. There was few calling in Students room. We can concentrate our work and study. CAPST has good security system. There are shower in CAPST for students and staff. It is useful for person who can't go to home.

There are many Korean restaurants near by Sungkyunkwan University. I used to go to lunch and dinner with students of CAPST. We used to go to lunch in the school cafeteria together. You can eat nice Korean food in the school cafeteria. The price is about 2500 wan. It is reasonable price for students. The distance from CAPST to the school cafeteria is about 10 minute walk. We used to talk each other in English about Japan and Korea on the way. We become good friends. Though this conversations, I learned Korean

word by the students of CAPST and taught them Japanese word such as “hallow”,”Good”,”Excuse me” and “ Nice to meet you” in Japanese. As a result, I can speak a few words in Korea which means hello, thank and excuse me etc. Then I have leaned Korean for speaking and understanding Korea more. I want to couture to learn Korean for speaking in Japan. This experience of talking with students in CAPST is very fun for me.

One of the surprising things in Korean food culture is free for side dishes. You can have free refills. Korean food is reasonable price. Korean food is very nice for me. I have eat a lot of Korean food such as kimchi, bibimbap(rice mixed with seasoned vegetables), Korean kalbi for 2 months. The most impression dinner in 2 months is eating with Mrs.. Kim’s family. She is the secretary and student in CAPST. She studied LIF in CAPST. She has a curiosity about everything. She invited us (Japanese students, student and staff in CAPST) for dinner. We ate Bulgogi and traditional Korean food. I talked with Mrs.Kim’s family. This is great time for us. It is very fun.

In aspect of living in Korea. I was helped by Mr. Doo Hoon who is master's course student in CAPST for a lot of things about Korea.. In the beginning of visiting Korea, I have no basic needs for living in Korea. I didn’t know the place for the supper market around Sungkyunkwan University. Few people can speak English around Sungkyunkwan University because of the country. Almost people only speak Korean in Suwon. I went to supermarket which named E-mart with two students in CAPST by car. . I bought thing for living in Korean in this supermarket. He is very kind for us. He’s age is close to my age. I made friends with him.

I went to play in Seoul with Sakai, Mr. Doo Hoon and his friend.. For example, we went to Mondong, Cheonggyecheon, Sinchon, N Seoul tower .He guided the place we went for us. Especially, the impression thing for me is episode of Cheonggyecheon. President Lee Myung-bak reconstructed Cheonggyecheon. Cheonggyecheon was not clean a long time ago. After that, we talked about top company in Japan and Korea.. He said to me that any engineer and researcher will be affect by world economics or politics. And we need to attend world economics and politics. From these conversations, I thought that I need to know more economics and politics and many engineer and researcher need to know business world economics or politics for great successes. I have to learn more world economics or politics.

For leaning and understanding korean couture. I went to folk village and Gyonjiu. These places are recommended by the students in CAPCT. The day I went to folk village was chinese new year. There were many visitors in folk village. I watched performance such as traditional dance, high jump with seesaw and balancing act. I went to historical museum in folk village for more understanding Korea.n history and couture. Gyonjiu is historical city in Korea. You can watch historical house, temple and Buddha statue in Gyonjiu. It was great experience for me to know historical things about Korea. Korean culture is very interesting for me. I went to many place in Korea such as Mondong, Tondemong, Nandemong, Sinchon, Hongdae, Suwon, Fork Village, Busan, Gyonjiu when on holiday for understanding Korean couture.

At last day in Korea, I and Sakai presented message care which printed picture for thank all students and staff. This is Sakai’s idea. I though this is very good. We write message for all students and staff in CAPST. When they said thank you for this message card, it is very pleasure for me. This is memorable events in Korea. I want to continue to get a connection. I want to see them again if I have chance.

The visiting to Sungkyunkwan University by International Training Program is great experience for me. I leaned a lot of things from studying different study from my specialized field in Japan. I have made friends with the students in CAPST. I leaned Korean cultures and history for understanding Korea. This experience will affect my life.

Actually, I was not sure this International training program in Korea is good or not for me. Because I had a lot of worry about study, people and culture in Korea before International Training Program started. At the same time, this International Training Program in Korea isn’t only study. This program is including learning culture, making friends. From now, I am sure this experience was very good for me.

This International Training Program was realized by many people. I’d like to everyone concerned. At last, I’d like to thank Professor Han and Staff in International Training Program for giving me the great opportunity. And. I'd like to thank all student and staff in CAPST for your kindness and

your help you gave. I hope that this International Training Program will success more.