Report on Visit to Sungkyunkwan-University Korea by International Training Program

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I participated in a long-term dispatch program of ITP (Intenational Training Program) this time. I report it here.

I studied the plasma technology in CAPST (Center for Advanced Plasma Surface Technology) in Sungkyunkwan-University Korea. from August the 15th to October the 13th of 2010. While I stayed, I belonged to the professor Han's lablatory. Professor Han acts as a director of CAPST.

About a Sungkyunkwan-University

The history of Sungkyunkwan is old, and it is said the oldest university in Korea. In addition, it is known as the university which the Samsung electronics which is the Korea's greatest company supports. Therefore environment for studies such as a research facility or a huge library was substantial very much. There are two campuses in Sungkyunkwan-University. A faculty of liberal arts department and an art department are set up in the Seoul campus. A physical science department and a physical education department are setup in the Suwon campus. There is CAPST of this dispatch in the Suwon campus located in the south to approximately 40km from Seoul. There was many green in the site and I took a walk in a lunch break and refreshed a feeling.

About a study

I studied the solar voltaic using a `PECVD (Plasma Enhanced Chemical Vapor Deposition) device in Japan. Therefore Prof. Han had introduced Mr. Shin to me. He studies the solar voltaic with Prof. Han who is the student of the Ph.D. program. Firstly we announced the conventional findings in a presentation form to know what kind of study each other performed. The device which Mr. Shin used in a study used magnetron sputtering technology. It was different from PECVD which I used in my study. He really showed a device. I studied magnetron sputtering technology. And I understood a study of Mr. Shin while comparing a difference between PECVD and the sputtering.

Research background

The photovoltaic power generation is technology to convert light of the sun into direct electric energy by the photoelectric effect of the semiconductor. Recently, attention is paid to the photovoltaic generation by various viewpoints like the environment, energy, and economy, etc. However, there is a big problem that a generation cost is high. The improvement of the electric conversion efficiency and the reduction of the production cost are necessary to solve this problem. Low exploitation of resources and approach to lower a generation cost by an area very much are continued. There is the film manufacture technology that I used magnetron sputtering for as promising technology. A comparison of PECVD and sputtering process, it do not use dangerous gas such as the SiH_4, the sputtering process is safe.

And it is advantage in that the device is cheap.

A purpose of the study

A purpose of this study is to make a micro-crystalline silicon film of high quality with a magnetron sputtering device. The micro-crystalline silicon film has advantage of the bandgap is small and carrier mobility is bigger than the amorphous silicon film. The micro-crystalline silicon film is expected as high-performance device materials of the silicon bases such as a thin-film transistor for flat-panel display or the solar voltaic. The fall of the energy conversion efficiency by the light irradiation becomes the problem with the amorphous silicon thin film solar cell. The big advantage of the micro-crystalline silicon thin film solar cell has little deterioration by light.

About an experiment

We used the device which put CFUBM (Closed Field Unbalanced Magnetron Sputtering) and ICP (Inductively Coupled Plasma) together. We changed substrate temperature or a position and tested it. We evaluated the quality of films such as film deposition rate, the composition of the film, crystallinity with probe-type step film thickness meter and FT-IR, Raman spectroscopy.

Study life

While I lived in Korea, I went to the laboratory at 8:30 every day. And I performed an experiment, study and came home at about 8:00 p.m. Suwon was comparatively cool in the summer and was able to spend staying two months comfortably. All the communication in the laboratory performed it in English. I was not able to understand even a simple English word such as "student" and "book" because of the difference of the intonation at first. While I talk with the student of the laboratory every day, I am gradually used to pronunciation and think that I was able to deepen interchange while bringing a gesture hand gesture. I think that the English training before the dispatch was useful for this very much. However, I was not able to tell to be good at wanting to say and felt regrettable many times. I felt English language necessity. I participated in a special lecture of plasma at the Sungkyunkwan-University during 9 days from August 23th. Prof. Jeon G. Han (Sungkyunkwan-University) Prof. Matthew Goeckner (The university of Texas), Prof. Masaru Hori (Nagoya University), Prof. Masaharu Shiratani (Kyushu University) lectured. I could take foundations of plasma and application lecture of wide contents, and it was studied very much.

About a meal

I worried about a meal before I was dispatched. Because I heard the story that all the Korean food was too spicy. It is food delicious entirely. The meal was everyday pleasure. I bought a sandwich or a rice ball in the morning in a convenience store and ate in a laboratory. At lunch and dinner, I went to a dining room and the restaurant district nearby with the student of the laboratory and ate. The menu was written by Korean and was hardly readable. They explained it to me what kind of cooking it was. I was able to eat various Korean food. Cooking as the top of the table is filled up with a dish comes out in Korea. I can eat the all at a reasonable price to the full deliciously. There are many restaurants in the neighborhood of the school. It always did well even midnight of the weekdays. On an off day, there was time when it was necessary to take the meal alone. Neither the Japanese nor the English went in the restaurant and had a hard time very much to order it. It was a valuable experience to convey intention in the situation that I did not know at all of words.

In addition, a meal in Korea cannot miss kimchi. In the dining room of the school and the shop, kimchi is set by all means. When I was invited by Mr. Doo H. Song who was a graduate of Sungkyunkwan-University, I found the special refrigerator which there was not in Japan. In Korea, it is a refrigerator for exclusive use of the kimchi which the family has as for one of them in all home. This refrigerator can keep the temperature that is most suitable for kimchi and can eat delicious kimchi throughout the year.

About accommodations

I lived in a room for overseas researchers called a guest house for two months. It is located 10 minutes walk from the laboratory. And It kept most of the facilities which were necessary for life such as a refrigerator, a washing machine, an air-conditioner, a shower. I could connect it to the Internet from the room and was able to live without any inconvenience while I stayed.

About culture

There is the event called *Chusoku* that resembled *Obon* in Korea. August 15 of the old calendar and the front and back are a holiday and all the relatives gather in hometown and do an ancestral visit to a grave and thank an autumn crop and spend it every year. This year, September 22 was a *Chusoku*. And most such as a school and a company, a restaurant were closed for the period. It was very impressive that student's town fell silent. Because the student's town was lively even by the midnight of the weekday. Korean is strong in Confucian mind, and courtesy for ancestors and the older person is thorough. I feel that such a culture fades in Japan. I think that I must follow it.

About sightseeing

I had the advice of the professor on a holiday and went to the sightseeing to Hwaseong Fortress registered with a world heritage. Hwaseong Fortress is remains of the forts of the Li-regimed Korea times in Suwon city.

I had trouble with until I arrived at it, because there was not guidance. I got to know with the Russian foreign student who was at a loss in the same way as me on the way and decided to go around the Hwaseong Fortress together. I could tell differences with each other's countries and Korea and was able to spend very significant time.

What I learned by research dispatch

By this Korea dispatch, I was able to learn many things. About the study, I learned product in film technology by magnetron sputtering. And learned the evaluation technology of films such as film thickness measurement, FT-IR, Raman spectroscopy. Furthermore, I was able to stare at the study that used plasma from different viewpoints again.

I was able to understand about film deposition, surface reaction by an electron, an ion and the radical are important.

In addition, I was able to learn various ways of

thinking by coming into contact with students, the professor, local people and culture. And the biggest gain that I got by this dispatch is to have been able to recognize a point lacking of oneself clearly. Not to speak of the experience about the study and knowledge being insufficient. I was able to find an indicator how should have gone in future to grow up as a researcher.

Acknowledgement

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