Report on Visit to Queen's University Belfast by International Training Program

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Ⅰ.Introduction

In this time, I attended the International Training Program (ITP) to participate in long term exchange for two months from November 5, 2012, and I researched at Prof. Bill Graham's group in Centre of Plasma Physics of Queen's university in Belfast. I will report it as follows

Ⅱ.Queen's university Belfast

Queen's university Belfast (QUB) is located in educational district which is in the southern direction of Belfast, Northern Ireland. There are Ulster museum and Garden in this area. So the place around university is very relaxing area. QUB is one of the Russell Group that is an association of 24 British public research university. QUB was founded in 1845 and has been traditional school for more than 150 years..

There is Mathematics and Physics in QUB. Centre of Plasma Physics (CPP) to study plasma physics is set up in Mathematics and Physics. Fig.1 shows CPP building. Prof. Graham's group is member of CPP and studies atmospheric pressure plasma, plasmas in liquid and applies plasma to medicine and biology.

Fig.1 : Centre of Plasma Physics

Ⅲ.Life in Belfast

Belfast is much higher latitude than Japan. Therefore, hours of daylight are shorter and colder than Japan. It is often rainy day but I didn't need to umbrella because of small rain. I kept off rain using hood. I think public security was not bad.

I contacted accommodation staff from QUB's homepage and asked about accommodation. I couldn't use student accommodation. Therefore, I lived in staff accommodation. There are the bare necessities, home electronics and daily goods and so on, in the accommodation. So I was not in trouble to live in Belfast.

The accommodation is very near university. It takes about ten minutes to go to university. I was not in trouble to eat because there are a lot of supermarkets, cafeterias, fast food shop and special restaurants. When I went out to eat, I often used cafeteria and fast food shop. It costs ￡5～6 to eat and I was satisfied with diet but I felt there is much amount of diet. I think it was not high price to eat due to high yen. When I was in accommodation, I watched the news and movies on TV.

On holidays, I walked around Belfast and Dublin. Belfast is developed centering on City Hall. There are a lot of stores and shopping mall around City Hall and I enjoyed window-shopping. Before Christmas, the market was held in front of City Hall. It was crowded with people. I felt how they love Christmas. Before the Christmas, I experienced Christmas party in Northern Ireland with Prof. Graham.

Ⅳ.Research activity

On the first day of QUB, I told Prof. Graham and decided to study plasma simulation using Comsol. Comsol is a simulation software made by Comosol AB company. Using this soft, plasma simulation can be done concluding every physical phenomenon. On first week of my stay, I watched safety training video and Mr. Andrew taught me how to use simulation program. On second week of my stay, I made a presentation of my study in Japan in ten minutes. After those, I simulated atmospheric pressure plasma concluding my experimental conditions (Fig.2).

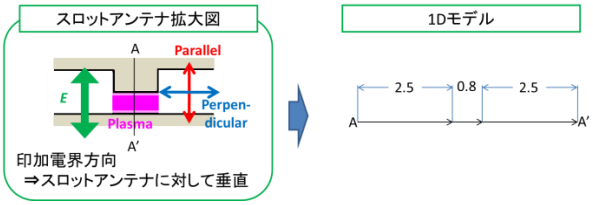

Fig.2：Simulation Setup

I investigated chemical reaction and cross section data of Ar because I used Ar in my study in Japan. After that, I inputed those data into Comsol. Fig.3~Fig.6 show cross section data of Ar.

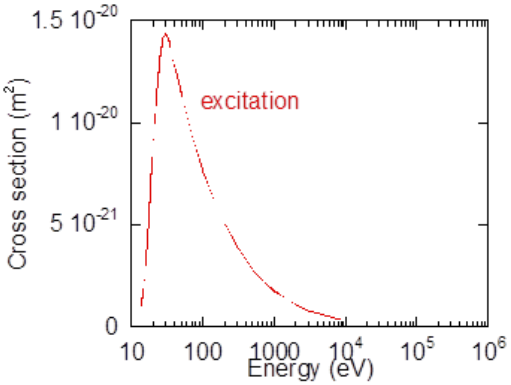

Fig.3：Cross section data of Ar excitation

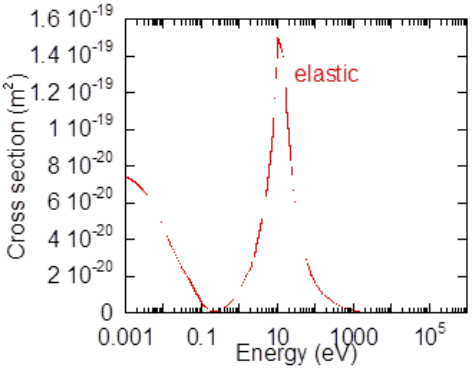

Fig.4：Cross section data of Ar elastic

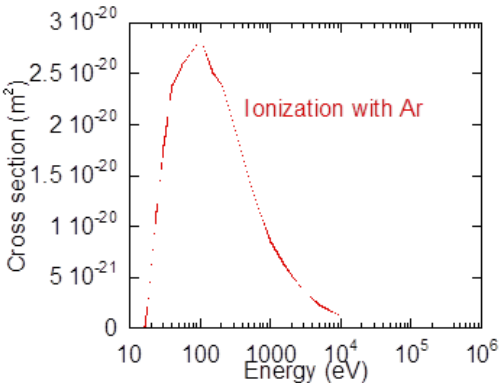

Fig.5 : Cross section data of Ar ionization

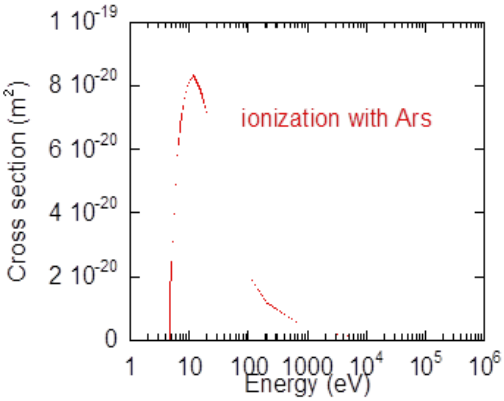

Fig.6 : Cross section data of Ar ionization

Fig.7(a),(b) show gap distance dependence of time-resolved electron density. These figures indicate that the more gap size is wide, the more electron density is large. Electron density increses with time. Because gas temperature was defined as constant and I didn't considered temporal variation of gas temperature. Fig.8 shows temporal variation of ion density with d=0.8 mm. Ion density is oscilated because the voltage with 13.56MHz is applied. Fig.9 (a),(b) show comparison electron density with ion density at T=250 ns and T=10 μs. electron density is equal to ion densiy in the center of plasma. This is because plasma maintains electroneutrality. At T=10 μs, ion density is larger than electron density near the electrode(d=0.7~0.8 mm). This indicates that plasma makes the sheath near the electrode when plasma contacts with electrode.

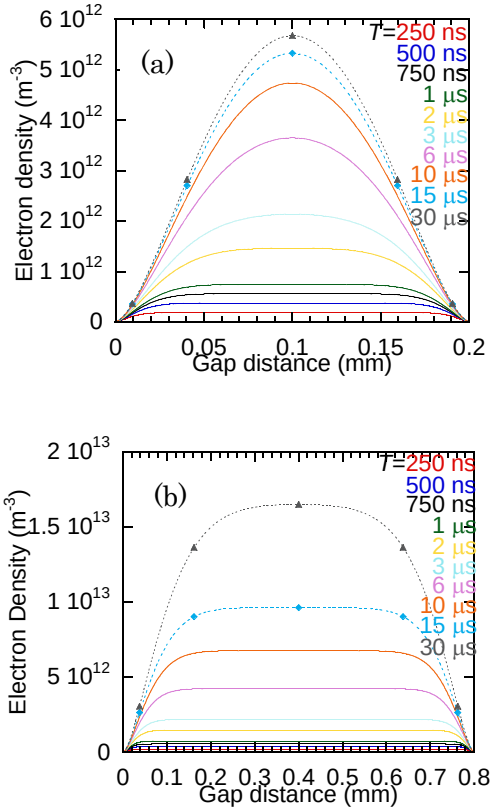

Fig.7 : Temporal variation of electron density with (a) d=0.2 mm and (b) d=0.8 mm

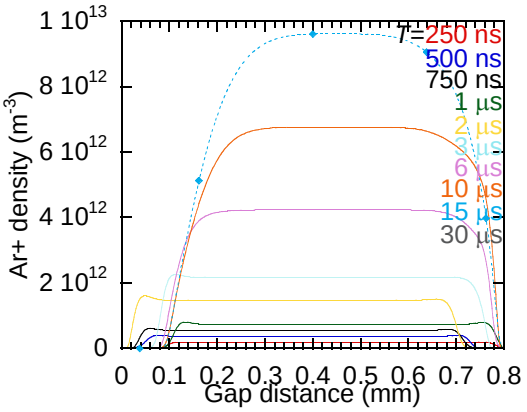

Fig.8 : Ion density in d= 0.8 mm

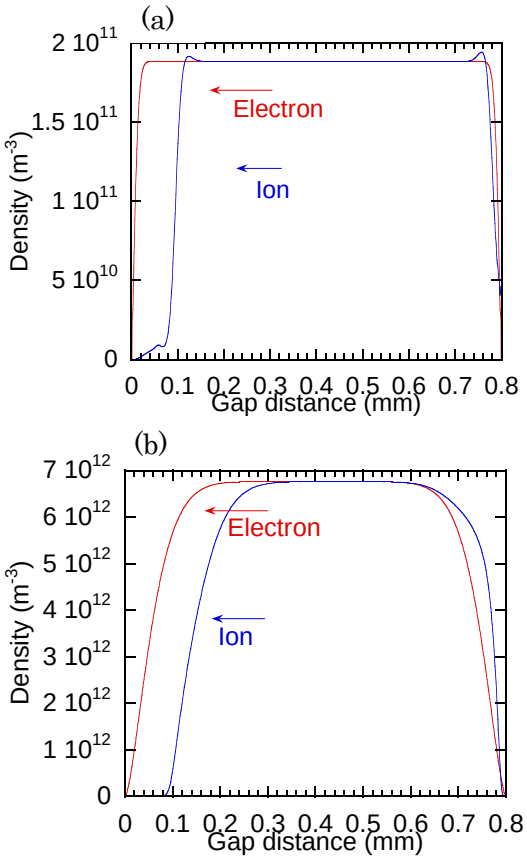

Fig.9 : Compared electron density with ion density at (a) T=250 ns and (b) T=10 μs

5.Study Life

The meeting was held on every Tuesday in Prof. Graham's lab. At first, every people who attended the meeting talked progress of study in short. After that, two people made a presentation. The presentation time was twenty minutes and we discussed after presentation was finished. They confirmed what they did each other by doing this. In addition, I often visited Prof. Graham to discuss my research.

6.Conclusion

At first, I was not only fun but also anxious because I hadn't lived alone yet. I finished my research life in Belfast with assistance of a lot of people. In this time, I have a lot of experience that I had not had experience in Japan and It was a good chance to learn different culture. In addition, I developed my research and it was a good time. I think I made my life useful with this experience.

Finally, I express my gratitude to Prof. Graham, all members in his lab and Prof. Hori, Prof. Toyoda and ITP staffs who gave me this beneficial opportunity.