

Internship Report

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Abstract

This report is about my private and professional experiences during my six-month internship at the Center for Advanced Life Cycle Engineering of the University of Maryland in the United States of America.

1 Application

At the end of the fourth semester Professor Boggasch told me about the great opportunity to make an internship in the United States. I always wanted to work abroad to learn more about another culture and see if I am able to adapt to the new conditions. After conversations with some previous interns and research about the program I decided to take the chance and applied for a place. Then the paper-warfare began I had to create various documents like a letter of application, curriculum vitae, and a letter of motivation also at least three letters of recommendation written by professors or other persons which can confirm my qualification for the internship but due to the help of Professor Boggasch and my predecessors it was quickly done. In addition to that I had to pass a short English test to get a language certificate and a bank statement that proof my ability to finance the trip. After a few days of waiting I got a internship placement plan which contained the job specification and the contact information of my supervisor.

2 Travel Arrangements

Subsequent to the application process I had to go through the J1 visa procedure. The first step is to pay the service fee and make an appointment for a visit of an American embassy. The second step is to collect several documents which contain a few documents from the Department of State, passport and all documents of the application process. Fortunately a fellow student also got an internship in the same institute as me. So we could split the expenses for the trip to the embassy in Berlin. The visit in Berlin took a day and consisted of hours of waiting and a short interview about my work in the United States.

After a week of searching we found a relatively cheap apartment which is approximately ten kilometers away from the UMD¹. Finally we bought the flight tickets.

3 Arrival and Journey

After a lot of security controls and a nine hour flight we finally landed in Washington D.C. where our landlord picked us up. We met the previous interns from Wolfenbüttel by the arrival in the apartment. Following a short flat viewing our landlord invited us all to a dinner in a restaurant where we ate our first American cheeseburger.



Figure 1: Apartment

4 New Environment

We had separate rooms a kitchen and a small bath also a washroom. The apartment was equipped with television, microwave, hotplates, refrigerator and basic tableware. Further a couch, wardrobes and two beds. Our internship began one week after our arrival. Thus, we had enough time to explore Washington D.C.

¹University of Maryland



Figure 2: Washington D.C.

and the UMD. The first time for me being in the USA, I was surprised that everything is exactly as you imagine. I wouldn't have thought that everything looks like in the movies, but it is really like that! The trucks, the buildings, the fast-food restaurants and super-markets. The UMD campus includes more than 350 buildings spread over 5580 km² and offers a broad coverage in the traditional arts and sciences with advanced degrees in more than 90 fields of study. There are more than 37,000 graduate and under-graduate students from countries all over the world and a variety of backgrounds. Washington D.C is a beautiful city with many parks, public museums great architecture. It is not build in blocks like the most city's in America bud in circles around the Capitol which make it much more complicated to find the right way.



Figure 3: University of Maryland

5 Work

I worked in the Test Services and Failure Analysis Laboratory (TSFA) which is one of the most sophisticated labs in the world. The TSFA Lab performs standard and custom tests and failure analysis services, including proprietary services that may range from a day to several years. It is equipped with some of the latest analysis technology like nano-focus X-ray system capable of 3d imaging, XRF² equipment to characterize lead-free solder and other electronic packaging materials, and also an scanning electron microscope. The specific objective of my internship were to conduct degradation analysis on lithium-ion batteries in ambient temperature and then at elevated temperatures. Observe the electrodes physically to understand the causes of degradation. To for fill this objectives I needed to acquire the necessary knowledge and skills which means to read many papers and absolve a lot of training. In the first week I got in touch with my supervisor and my predecessor they lead me through the paperwork and introduced me to the most of the devices. My working hours were 8 – 17.00. The day started with an morning meeting from 8 to 9 with all the members of our project group which consists of 15 doctoral students 5 interns the two lab managers and a various number of professors. The objective of this meetings is to give every participant an overview about the work of each other therefore one person per meeting had to give a presentation. During the first weeks I had to participate on trainings and tests to use the X-ray Machine and the ESEM³.

²X-ray fluorescence analysis

³Environmental Scanning Electron Microscope

After this time of introduction I began to work on my main project but I also got tasks which belongs to other projects. The desks of the lab manager research assistant and mine were directly located in the lab. Thus, it were sometimes very noisy and crowded but it made it easy to get in touch with the colleagues and conduct the daily measurements. One typical task was to conduct the battery cycling to simulate the battery life and study the effect of various charge and discharge conditions. One cycle correspond to one standard charge and discharge procedure of a cellphone battery. We examined some batteries of a test series in intervals of a certain number of cycles. The first step of the examination is the non-destructive analysis which consists of structural scans (x-ray imaging, ct-scan) and electrical measurements (electrochemical impedance spectroscopy, internal resistance measurement, Capacity, Current, Voltage). A further step is the destructive analysis, which includes observations of each component with the ESEM, EDS⁴ and the cross-sectioning technique. In the last weeks of my stay I modified a macro program (ImageJ) to automate the particle measurement of the electrode surface. This program used the existing data of the ESEM analysis. The ESEM enables high magnification observation of the surfaces of the anode and cathode material. I presented the progress in form of meetings to my supervisor on a weekly basis or more frequently, depending on the occasion. My internship ended with an final report about 50 pages and a presentation to the research group. The working atmosphere were very nice everybody was willing to help. During the whole internship I felt as a full-fledged member of the research team. I particularly appreciated, that my supervisor would let me work independently, and included me in some decisions.

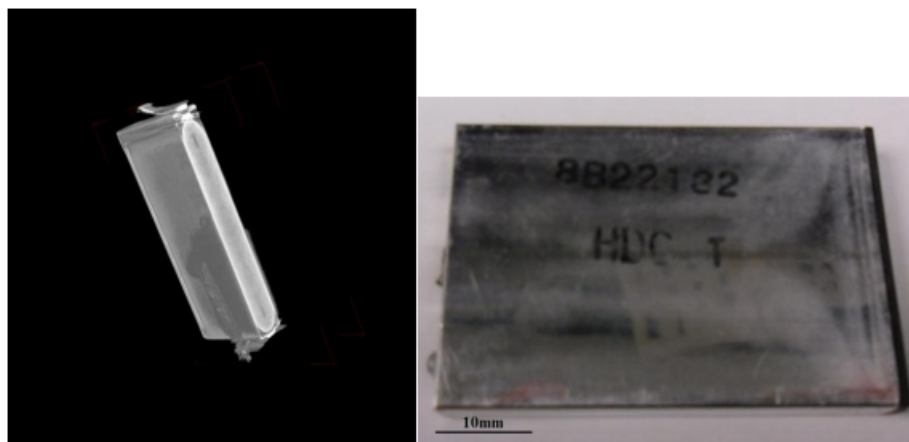


Figure 4: 3D CT-Image and Battery

⁴Energy-Dispersive X-ray Spectroscopy

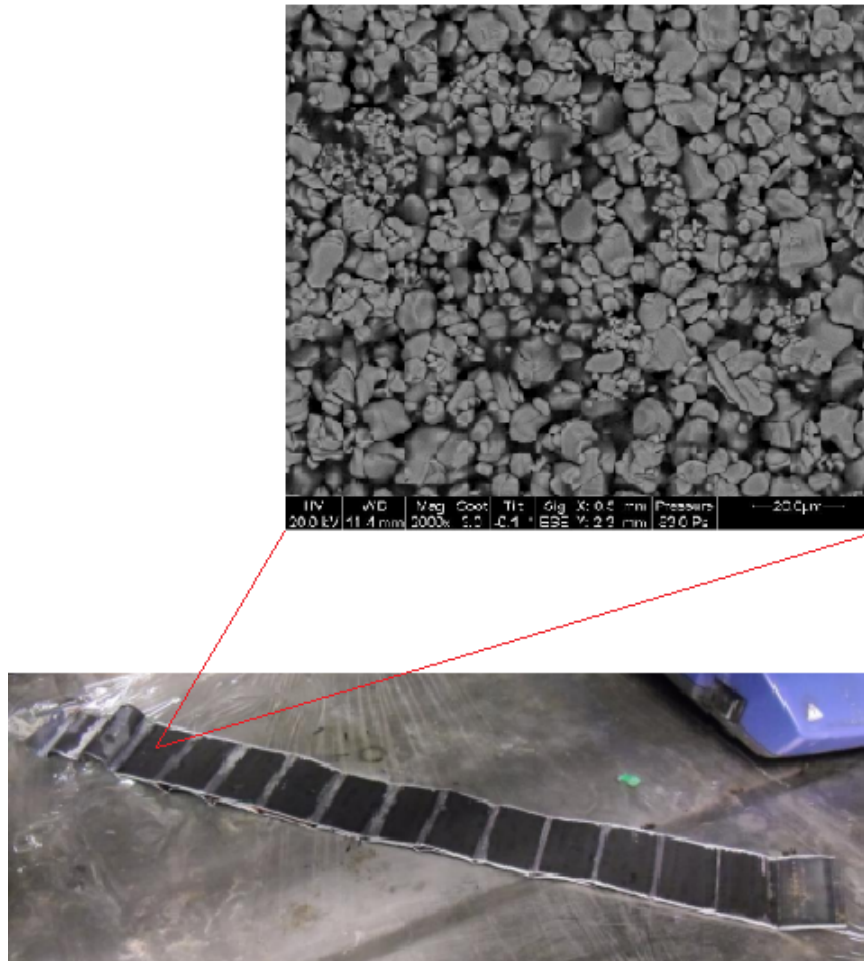


Figure 5: ESEM Picture of the Cathode

6 Social Life

I have met a lot of other interns and students who also worked at the UMD, and they were not only from the U.S., but also from Korea, China, Japan and India. We were spending a lot of time together and after work as well. Visiting various festivals, going to the cinema, traveling and going out on weekends were just some of the things we have done together. Especially the Trip to New York and the Visit of an classic American Christmas party were pretty awesome. In

general, the Americans are really open-minded and there was no day without getting to know someone new. As an example in the beginning of my trip I had five friends on Facebook and in the end more than 200.



Figure 6: New York

7 Way Back and Subsequent Contact

After a farewell lunch with the lab-team and say good bye to all my colleagues and new friends I had to pack my things and fly back to Germany. I am still in contact with some colleagues and interns. Especially with the research assistant of my project team who is planning a trip to Germany for the next year to visit some German friends including me. Besides I had a video conference with some people of the laboratory to show them how to do a CT⁵ scan.

Sometimes it was funny, sometimes it was hard but at the end I was happy because the effort was worthy. At the end, I must say that it was a wonderful experience in everything. It gave me a new vision for my work and for my country as well. I would like to thank the organizers and coordinators of this program, and I wish that many other students may have the chance to join in next year.

⁵X-ray computed tomography

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