

Armourers & Brasiers' Report - Sophie Mance Corpus Christi College

Institute of Metallic Biomaterials

Helmholtz-Zentrum Hereon

"I'd like you to write the manuscript" were not the words I was not expecting hear on the first day of my placement at Helmholtz-Zentrum Hereon (HZH). I'd met briefly with my supervisor Dr Domonkos Tolnai, on Zoom before arriving in Germany to discuss the project, so I knew the research was aimed at publication. What I didn't expect was to be given responsibility for the preparation of paper where I would be the first author. My name is Sophie Mance, I am about to start my third year (Part II) of Natural Sciences at Corpus Christi College Cambridge and will be specialising in materials science. Thanks to the CaMPUS European Placement scheme and the generous support of the Worshipful Company of Amourers and Brasiers, I undertook an eight week placement at the Helmholtz-Zentrum Hereon in Geesthacht, Germany.

My project had the catchy title "In-situ Synchrotron Radiation Diffraction Study of Compression of AZ91 Composites Reinforced with Recycled Carbon Fibres". In the study we used brilliant x-rays generated in a synchrotron, a type of particle accelerator, to study how strain builds up on different planes of atoms when composite materials are compressed.

This project encompasses what I find fascinating about materials science; how an understanding of the arrangement of atoms influences the properties of a material and how that can then be exploited. AZ91 is a magnesium alloy that is 90% magnesium, 9% aluminium and 1% zinc. Magnesium alloys are of particular interest to aerospace and automotive industries as they are lightweight so can help produce more efficient vehicles. To achieve the strength and durability needed for these applications composite materials are being investigated. My material uses carbon fibres recycled from carbon fibre reinforced polymers, as a keen environmentalist this was an added bonus!

Most of the experimental work for this project had been carried out before my arrival, I had to analyse the data and wrangle it into a presentable form. This involved learning to use new software to deal with the vast amounts of data, for each of the 9 samples there were over 3000 images taken by the x-ray detector! I also learnt to use Origin, which is like Microsoft Excel on steroids, to produce publication quality graphs. When I was working on projects for science fair, my high school physics teacher would ask me to think about how I could use my results to tell a story. Figuring out how to turn my results into a cohesive narrative for publication in a journal was challenge I relished. Like all research things didn't always go to plan. After puzzling over a few particularly bizarre results for a week, it was only after my supervisor encourage me to carefully retrace my steps that I spotted a mistake and was able to reanalyse some data and obtain something much more sensible.

Analysing the data was only half the job, to properly understand my results and be able to write my manuscript, I had to read up on diffraction, magnesium alloys, and composite materials. I really enjoyed building on what I'd learned in Part I of the Cambridge Materials Science course. Magnesium has a crystal structure known as 'Hexagonal Close Packed', the metals I have studied so far tend to have cubic crystal structures so I was encountering familiar concepts in a new context. HZH works extensively on magnesium and its alloys, many papers I read had at least one author connected to the research centre, so I was in good company to answer my questions.

HZH is a research institute for Materials Science and Coastal Systems with a large number of international staff and students. Whilst in Geesthacht, I lived in a big guesthouse owned by the institute and home to 24 people; interns, masters and PhD students from all around the world. In fact, my most confusing moment wasn't getting my head around the geometry of crystal lattices but



New Zealand Dinner at the guesthouse, spot the pavlova!

trying to have conversations in the communal kitchen in three languages at once! I speak English, French and Dutch and had studied a bit of German in school so I wanted to use my placement to improve my language skills. The social aspect of the guesthouse helped with this, I spent my working days in English, would have lunch with a French colleague, and speak German with a Polish intern. I really enjoyed getting to know the other residents of the guesthouse, we would share meals, music, and movies from our own countries, and with people from 10 countries there was quite a range!

Geesthacht is a small town, about an hour by public transport from Hamburg. I enjoyed getting to know Hamburg one cool event was the 'Hafengeburtstag'. A celebration of the harbour's birthday featuring a parade of all sorts of ships down the Elbe, even the rain couldn't dull the mood. I got extensive use out of the €9 train ticket offer and spent almost every weekend in a new place. I explored the state of Schleswig-Holstein which is home to many beautiful small towns and cities, as well as places further afield like Berlin. I also made it out of Germany to Poland, The Netherlands, Denmark, and France. The advantage of not doing much lab-based work was that I could occasionally work remotely from a library in a new city or on a train.



Hafengeburtstag



Polterabend aftermath

My family spent a few years living in Europe while I was growing up, spending a summer working in Europe, especially after covid meant I could catch up with old friends. Distance wise the hop across to Europe from the UK doesn't compare to moving to the UK from NZ, but the language barrier and cultural differences were definitely larger. My German improved throughout the placement, I learnt just how many syllables to drop from *Entschuldigung* and by the end of the placement I was talking about knitting to a local shopkeeper. I was introduced to the German tradition 'Polterabend', this celebration is to wish a couple good luck before their wedding and involves smashing plates. Of course, as a magnesium research department, the plates were smashed on a block of magnesium.

I am incredibly grateful for the support of the Materials & metallurgy Department and the Worshipful Company of Armourers & Brasiers that allowed me to complete my European Placement. I have learnt so much about what a career in materials science looks like, and am looking forward to starting the Part II course. Looking ahead I will definitely consider further study in materials science, hearing about the wide variety of projects happening just within magnesium proves that there will always be something out there that interest me. I have gained confidence in my language skills and, more importantly, in my scientific skills. Finishing this placement with a paper written and submitted to a journal feels amazing, eight weeks ago I wouldn't have thought myself capable of it.