

European Placement Non-technical Report: TUHH, Germany

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I am Rosie Baines and I am about to start my third year at Cambridge, studying Materials Science. I have recently returned from a very rewarding two month placement at the University of Technology in Hamburg-Harburg.

During the past year I decided to choose Materials Science as my option for third year as I feel it is a wide-ranging and innovative subject. My ambition is to work towards reducing the impact of human consumption on our surroundings, in fields such as implementing emissions-free energy or reducing the amount of unsalvageable waste. I would love to work in these areas, perhaps in initial research or in development for companies. This year I was looking for a placement that would give me practical experience and consolidate my decision to study Materials. When I first read about the European placement scheme offered by the Materials Department in association with the Armourers and Brasiers, I realised this would offer me so much more – a chance to experience living abroad, independence and collaboration within an international group.

I thought TUHH sounded like a supportive environment for this, and I couldn't have been more right. The team at Advanced Ceramics consists of mostly German, and several Brazilian, researchers with a range of ages. There is always a large group to go to lunch with, and plenty of takers for table football afterwards, which I loved! I was invited on the annual staff trip, and we went on a two day canoeing and teambuilding course, which introduced me to an even wider circle of friends.

My research task was to investigate the dielectric breakdown strength of TiO_2 , to see whether layered samples could be an improvement on bulk ones for a given thickness. Dielectric breakdown is the initiation of conduction channels in an insulator, caused by a potential difference across it. This is undesirable in devices because it can cause damage and is dangerous. Breakdown strength is the maximum electric field a material can withstand. The potential to extend device lifetime by using layered dielectrics was exciting to me as someone who is concerned by waste and inefficiency. I spent the first part of my placement making the samples starting from powder, learning new practical skills such as different types of pressing, using a sintering furnace and a very temperamental grinding machine! I was on course to finish my project very early, when I faced a problem – my samples were all conducting when only the slightest voltage was applied. I worked out that this was due to low density, and improved my methods accordingly. I had to race to get my new samples ready in time, but eventually I got some exciting data that showed my layered samples to be an improvement on the accepted trend for bulk ones. In my presentation I discussed further directions for research in the area and my colleagues have since been in touch to say they have assigned projects with that focus. I'm looking forward to hearing their results in the future.



Joining friends from the department for the Euros semi final



One of my TiO_2 samples

Visiting Germany was especially important to me. I have long been interested in 20th century history, and I participate as a musician at a lot of 1940s themed events. I was keen to hear the stories of the

people so often forgotten by these events – the German civilians. Visiting museums and learning about the horror of the Hamburg firestorms gave me the chance to explore this point of view. I took a train out to the cemetery where the bomb victims were taken, and had a peaceful walk there. I also found a way to combine my love of history with my passion for renewable energy by going on a tour of the Energiebunker, a Second World War bunker that has been converted into a huge sustainable power house that heats the district and supplies electricity to the grid.



The Energiebunker with its solar panels on top

I spent every weekend making use of the excellent public transport system to find fascinating places to explore, including inside a Soviet submarine which was thrilling! I visited the great cities of Berlin, Köln and Düsseldorf and took the opportunity to do some sightseeing in Denmark and Sweden. I even got to play Brahms' piano!

Although everybody in the lab speaks English, I tried to pick up some German when doing activities like shopping, and towards the end of my stay I went to see a film in German and visited an amazing traditional Schützenfest. With a friend's helpful advice I also developed a liking for typical German foods such as Sauerbraten.



The Hamburg Rathaus

Throughout the two months I felt my self-confidence increase, especially in the lab environment. During secondary school I was completely panicked by practical work and felt nervous to do any aspect on my own. I have improved since then but never fully shaken off that mentality until this summer. The feeling of going into different laboratories, choosing the apparatus I needed and using it to get the results I wanted has given me great confidence. Experiences like working out how to reset a complicated machine on my own - and being one of only two staff to be entrusted with a key to a dangerous high-voltage room – have been invaluable. They have motivated me with my work and made me look forward to my further studies and a career in Materials Science.



The high voltage machine where I took my measurements

My experiences this summer have truly meant a lot to me, and I am grateful to my hosts, and to the Worshipful Company of Armourers and Brasiers for their generous support, which makes this important scheme accessible. Thank you for your valued contribution to my academic career.