

# Armourers & Brasiers' European Placement Non-Technical Report

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*Thomas Southern*

I am a student entering my fourth year of studying Materials Science at the University of Cambridge. Over the summer I undertook a research project at the Paul Scherrer Institut in Villigen, Switzerland. I decided to enter the CAMPUS scheme to gain an opportunity to work in a real research environment. I expected this to help me make an informed decision regarding whether I wished to do a PhD.

The guesthouse I was staying at was located on the site of the institute. This made the walk to work very convenient at around 3 minutes. However this also meant that it was very isolated in the Swiss countryside with the nearest major town being a 40 minute cycle away. The isolation of the guesthouse does lead to a great sense of camaraderie between the long-term tenants of the guesthouse and we would regularly hold BBQs together, especially when someone was leaving.



## **A bittersweet night as 5 long term students were leaving the following day**

The location also lent itself to many scenic views, including the walk to the nearest shops just under an hour away. It also provided a good base to travel Europe from (once I had undertaken the 40 minute cycle to the station), allowing me to make trips to Prague, Berlin, Frankfurt, Dresden and Munich (twice). As someone with no German experience prior to my placement, some interactions were often a little comical; including my answering a waitress "Was the food okay?" with "No, thank you". I did begin to pick up a bit more as the time progressed.

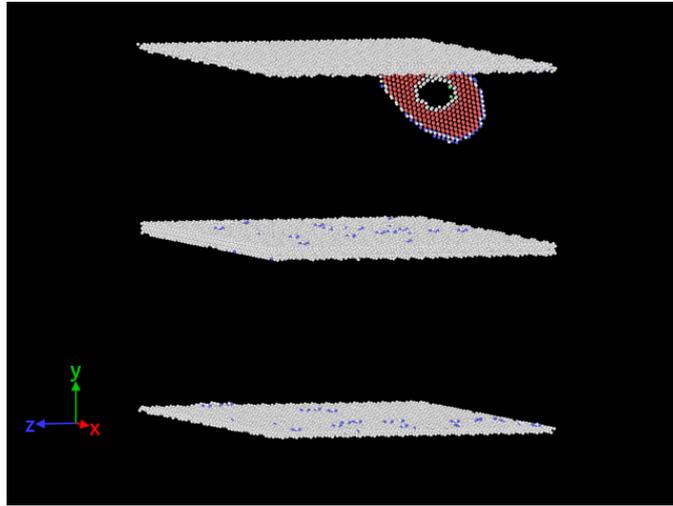


**The walk to the shops was quite scenic**

The group I was working with was very multicultural including, an Indian, an American, a Belgian, a German, a Frenchman, 2 Spaniards and 2 Czechs. Most of the people in the group couldn't speak German, which meant even in a non-work environment the language being spoken was English. This led to a very welcoming atmosphere and the group would usually get lunch and ice cream together to wind down. Team-building exercises were also common including volleyball, swimming and paddle boarding.

I was expecting the research environment to involve people working together more than I had found. While people did collaborate often, and going to talk to other group members was very much encouraged, people's research was very much their own project.

My project was entirely computational and involved simulating dislocation nucleation at a specific grain boundary in Aluminium. This first involved learning how to use the LAMMPS molecular dynamics software developed by Sandia. I used example files created by Tschopp to gain an understanding of the commands used. I then began to develop my own models to deform with both uniaxial and biaxial stress states. This was a new study building on previous works, which only study stress perpendicular to the grain boundary. The simulations I ran found interesting new results showing 3 different methods of plastic deformation around the grain boundary as the simulation cell was loaded along different axis.



### **Example of a full dislocation nucleating in a simulation run at 10 K**

My research skills definitely improved over the course of my placement. I learned more about how molecular dynamics works in a research environment. The placement allowed me to experience a real research group and gain more knowledge of the dynamic that is in place. Weekly meetings were held updating the group on every group members' progress. This was very informative and it allowed an insight into many different projects and contributed to my interest in a career researching materials science.

I'd like to thank The Worshipful Company of Armourers and Brasiers and the Department of Materials Science and Metallurgy of the University of Cambridge as well as the Paul Scherrer Institut for the opportunity to undertake this placement and their support during it.