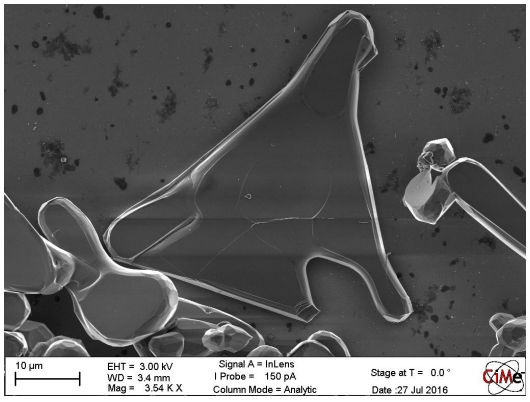
In two years of studying at Cambridge, I felt I had grown both academically and as a person, and wanted to experience the academic world first-hand. Cue the CaMPUS placements, offered by the Materials Science department in conjunction with the Armourers' and Brasiers' Company and various European universities. I think I've only truly began to appreciate what a fantastic opportunity this is, now that I've completed a placement at the Materials and Metallurgy lab (IMX) at EPFL in Lausanne, Switzerland.

I decided to apply for EPFL due to two main reasons. Firstly, I wanted to work by the Alps. I love hiking, and having seen the reports of some previous participants I knew I'd have free time during the 8 weeks fulfil one of my life-long dreams of hiking in the Alps. Secondly, having studied French during high school in Finland, I was able to speak on French, albeit only on paper. I had never reached a level where I was comfortable with using it, I felt this was an opportunity to finally learn to converse in French. In addition, I felt more comfortable going to live somewhere where I knew I could read the language, than say, in Germany. This fear did prove unfounded however, as Lausanne turned out to be a very multilingual city. If a future student is reading this, I would whole-heartedly recommend Lausanne even if you do not speak a word of French.

Somewhat naïvely, I expected the research environment to not so different from studying, and I travelled to EPFL with thoughts and ambitions of all the various things I'd accomplish during my stay there. The bubble burst on the first day. While I had always expected to have to work intensely, just the time and work required to read the literature on the topic, and on later days the time and effort to get all the methods and sample preparation to work, was much more than I expected. I now have a lot more respect for researchers, for the amount of hard work they have to put in, compared to how much of that I read in a scientific article. On the other hand, the working environment was very friendly, and I felt accepted right from the get-go. It reminded me in many ways of university, and I felt at home at work. For example, I participated in football practice with some of my colleagues, and never did I feel alone.



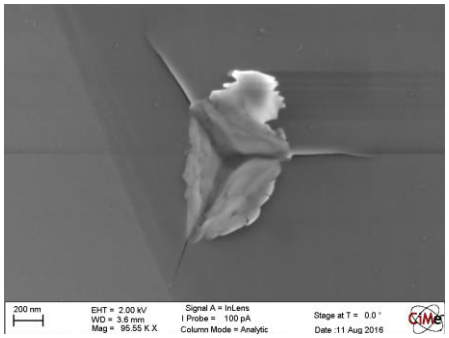
It's a particle! Dubbed "the plane" this one was easy to find in comparison to "the oval no 27" and "almost circular no 13"

For my project, I was given far more freedom that I expected. When I arrived, my research supervisor Martin Mueller only presented me with a question that he would like answered, and some basic ideas on how to get results. He also instructed me on how to use the equipment, and sent me numerous papers on the topic, the properties and indentation of silicon. This was surprising, and the kind of challenge I had been looking for, even if it turned out to be more difficult than I expected.

My research was motivated by the observation of occasional small aluminium inclusions in silicon crystals in aluminium-silicon alloys (not by me). Martin was

interested whether the fracture toughness of the silicon particles would be affected by these inclusions, but didn't have the time to research it, and so presented me with the challenge of finding it out. I worked with three materials (alas there was no time for more), single crystal silicon in the form of a wafer, and commercial and high-purity aluminium-silicon alloys. For the alloys, the silicon particles were extracted by dissolving the aluminium using electrolytic etching, placed in ethanol, and then poured onto a steel substrate. Subsequently the particles were indented on a Hysitron TriboIndenter, a piece of equipment more expensive than most houses, which used a sharp diamond tip to push into the material, generating an impression and cracks. These cracks were tiny, approximately 1µm in length, and just a few tens of nanometres thick near the point, and so were imaged in the SEM. From this data, the fracture toughness was then measured. No statistically different change was observed, which is perhaps more boring than if the opposite had been true, but I also now understand that for each breakthrough and prize-winning article, there are a hundred ones that only confirm or present results that are mundane in comparison, but just as important.

If presented with this information, I'm sure the me from before the placement would have thought this would take a few weeks to do. Instead it took nearly two months. That difference is also what I found to be the most educational part of the placement. It took me several days to have an idea of what nanoindentation was and some of its problems and benefits. That is not to say I didn't need to read more after this. I found out that there was constantly something new that I had to read up on, whether about the properties of silicon, or its response to very specific stress fields. After this, I desired some results, and so I spent days indenting the wafer, testing out loads, loading rates, differently shaped tips. In fact, a change of tip was needed after I realised that the used spheroconical tip did not result in uniform cracking as expected. And this was all without having deal with the minuscule particles, often less than 10µm in width, with all kinds of bumps and topography. All these complications meant it took a month before I even got my first results that I could use, and this was only on the wafer. Research is much more complicated than I thought. The placement taught me an invaluable lesson in patience and not rushing into something for want of results. If I started again, I would spend more time reading in the beginning, and many problems I faced later could have been avoided. The first-hand experience of this was priceless, and I feel very privileged to have experienced it.



Oh dear, this indent was supposed to be an equilateral triangle, but the particle wasn't flat.

The research I was part of was very international, with people from Argentina, Italy, Spain, Belgium, Croatia, Denmark, Slovakia, and of course Switzerland. There were 10-15 people present in the group, with many on summer vacations for a part of my time there. The group was chiefly composed of PhD and post-doc researchers. As the primary work language was English, I didn't get to practice my French at work, except on occasion during lunch breaks, resulting in less development than I expected.

During all this time, I did notice a marked improvement in my understanding of spoken French. Much of what I'd learned years ago came back to memory, and I felt comfortable with tuning into French conversations. However, my own speaking did not improve as much as I wanted, as I could get by with English most of the time, but I nonetheless appreciated the opportunity to revive some of what I knew and now feel more comfortable with the language.

While at work I challenged myself academically, outside it I challenged myself physically through hiking. I'd been in Switzerland as a kid, and it left me with a longing to return and hike. I made it a goal to challenge myself going up various lower peaks area. I hiked up to Rochers-de-Naye, which provided an incredible view of the surrounding area, with peaks from Mont Blanc to the Jungfrau. I hiked in the enchanting forests in the Jura mountains, and saw some of the Swiss countryside. I hiked to Haut Cime, with a fantastic view of Mont Blanc, and even the Matterhorn in the distance. It was breath-taking, sometimes literally as I climbed to over 3km. I also took the time to go around Lausanne when not hiking, and was able to observe the fireworks celebrations on the Swiss national day, which were fantastic. I also tried local foods, alpine cheeses and Swiss beer.

Some views speak for themselves. From the ascent of Haut Cime.

The placement has reaffirmed that I want to study materials science, and make a career out of it. Within the subject, my focus has perhaps shifted slightly. Observing some of my colleagues working on various computing and simulations for their research has convinced me for now that I want to learn different modelling techniques. During my stay, Martin instructed me in the basics of Finite Element Modelling, which I found to be especially interesting. Hence I've decided to start learning coding more seriously. Whether I want to do a research career or work in industry I don't yet know, but I aim to work in industry next summer, and then make a decision having experience both sides of the coin. Research has made a strong claim, but it's too early say for sure.

I'd like to thank Martin Mueller and the rest of the EPFL research team, the Cambridge Materials Science department, particularly Lianne Sallows, for organising the placement scheme, and providing me with an eye-opening opportunity to learn about the world of science. Furthermore, I'd like to thank the Worshipful Company of Armourers and Brasiers, EPFL, and King's College, Cambridge for financial support without which it would have been impossible for me to participate in the scheme.