

### **Non-technical A&B Report for Euro Placements: EMPA, Thun**

I am currently in my third year at Cambridge University, studying Materials Science. In the summer following my second year, I worked at the Swiss Federal Laboratories for Materials Testing and Research (EMPA) in Thun, Switzerland. I applied for this placement as the company specializes in nanomaterials, which is an area that I was interested in having experience working in. The area is also beautiful, with a wide variety of walking trails in the mountains, and the Aare river running through the centre of town, under plenty of jumping-in points.

The company itself was extremely welcoming, with a huge number of activities arranged by people working for both EMPA and Tofwerk, a closely related scientific research company specializing in Mass Spectrometry. These included inflatable boat trips from Thun to Bern, weekend hikes and weekly beach volleyball sessions, all of which I took advantage of. My colleagues were from a wide variety of backgrounds, mostly European, but often Indian or American as well. This made for a relaxed and friendly attitude towards communication, and many discussions involved comparing the same word in at least four different languages because someone had forgotten the English for it. I worked closely with only two people, my supervisors, although my office had several others that were all welcoming. English was the common language in the company, and most of the locals spoke it well too.



My introduction into my role at EMPA coincided with one of the Masters students leaving, and after a week or so of demonstrations and explanations, I continued her work into investigating the mechanical properties of thin (nanometer-scale) metal oxide films on polymer substrates. These thin films have many promising uses as barriers for gas diffusion in the production of food/drink packaging, flexible OLED screens, and other semiconductors. They therefore must be able to withstand bending and stretching without cracking or buckling, as this makes them less effective as barriers. I tested multiple samples under tension to determine the adhesive strength (at the film/substrate interface) and cohesive strength (within the film itself). These values were compared for ZnO and Al<sub>2</sub>O<sub>3</sub> films, as well as films made of alternating layers of ZnO and Al<sub>2</sub>O<sub>3</sub>, to identify ways to make these films sturdier and more effective barriers. My final report is titled "Investigating the fracture mechanics and toughness of

LT-ALD Alumina and Zinc Oxide nanolaminates on Kapton".

This work gave me valuable insight into the process of writing and presenting a scientific report, especially reading and appraising published papers to reference. The experimental work was enjoyably interactive, and I was given opportunities to investigate questions not directly connected with my overall project if they interested me. I had



expected to be working within a rigid system, from the short research placements I had worked in before university, but it was much more interesting to have some agency over my project's direction. This did sometimes introduce issues, as without a comprehensive knowledge of all of the theory, mathematics and programming behind the models and algorithms I used in my evaluation, it was difficult to interpret the data. This was overcome by both my own research into the context of my work, and suggestions from my supervisor.

Overall, I enjoyed my placement at EMPA, for the company, location, and support I received while there. It was an interesting area to work in, and will be one of the specializations I look into as I continue my degree. This placement has encouraged me in pursuing a career in materials research, and I would like to thank the Worshipful Company of Armourers and Brasiers for their support in making the most of this opportunity.

