CaMPUS Placements: UK Industrial - Reports 2014

Below are reports on the Summer Placements provided by students who participated in the scheme in 2014.

Granta Design, Cambridge

Report 1

1. General

Placement Location: **Granta Design**
Arrival and Departure Dates: **July 1st – September 26th**
No. of working days spent at Institution: **64**

2. Financial

Where did you stay during your placement (town name)?: **College accommodation (Cambridge)**
Total cost of daily travel to and from Institution (£): **Free**
Total received from Institution (£): **£3900**

3. Research Project

Title of Research Project: **A database of functional materials**
Written Report submitted to host institution?: **yes**
Experimental Techniques used: **Literature review**
Interest level of project: on a scale of 1 (low) to 10(high): **8**
Quality of support provided: on a scale of 1 (low) to 10 (high): **6**
Interaction with other researchers: on a scale of 1 (low) to 10 (high): **8**

Short summary (~ 200 words) of technical content of project:

The aim was to extend the current CES Edupack Level 2 database to include functional materials, an area with very little previous coverage.

This involved researching different families of material to determine which attributes could be used to classify its functional properties. The literature was then surveyed to find the most commonly used materials and these were inserted into the database. For each new attribute, a brief explanation of the underlying science was written. Then figures of merit were researched for each property, and the software used to plot these.

Report 2

1. General

Placement Location: **Granta Design**
Arrival and Departure Dates: **01/07/2014-26/09/2014**
No. of working days spent at Institution: **64 (inc. 5 days paid leave)**

2. Financial

Where did you stay during your placement (town name)?: **Cambridge**
Total cost of daily travel to and from Institution (£): **Free**
Total received from Institution (£): **£3635.84**

3. Research Project

Title of Research Project: **Database Schema and Data for the Creation of Environmental and Health Building Assessment**
Written Report submitted to host institution?: **yes**
Experimental Techniques used: **N/A**
Interest level of project: on a scale of 1 (low) to 10(high): **8**
Quality of support provided: on a scale of 1 (low) to 10 (high): **10**

Interaction with other researchers: on a scale of 1 (low) to 10 (high): **5**

Short summary (~ 200 words) of technical content of project:

Database Schema and Data for the Creation of Environmental and Health Building Assessment

This project involved researching the current landscape of Environmental Product Declarations (EPDs) and Health Product Declarations (HPDs) for Granta Design so that the requirements of these two types of reports for the construction industry could be established. The aim was then to design a database schema that would allow the information required for these declarations to be stored in new product data records. A demonstration product was chosen so that a workflow demonstration for creating an EPD could be created, and this demonstration was the final outcome of the product.

Report 3

1. General

Placement Location: **Granta Design**
Arrival and Departure Dates: **01/07/14 - 26/09/14**
No. of working days spent at Institution: **64 (of which 2.5 days holiday, 3.5 days holiday not taken**

2. Financial

Where did you stay during your placement (town name)?: **Cambridge (college accommodation)**
Total cost of daily travel to and from Institution (£): **Free**
Total received from Institution (£): **£3767.60 (after NI deducted)**

3. Research Project

Title of Research Project: **ProcessUniverse, Resistance to Galling & Corrosion Attributes**
Written Report submitted to host institution?: **yes**
Experimental Techniques used: **Review of literature, data collection, using Excel alongside Granta software**
Interest level of project: on a scale of 1 (low) to 10(high): **8**
Quality of support provided: on a scale of 1 (low) to 10 (high): **10**
Interaction with other researchers: on a scale of 1 (low) to 10 (high): **9**

Short summary (~ 200 words) of technical content of project:

I was working in the data products team on 3 main CES Selector projects, all related to user requests. There was some use of the company software for importing data, but the majority of work was reading papers, collecting data and assigning values in Excel. Attention to detail and ensuring complete traceability of data was very important throughout for working in this team.

Updating additive manufacturing (AM) records in ProcessUniverse was predominantly researching the current literature on AM. Once it was established which processes should be included, simple descriptions were written, information was compiled from manufacturer data sheets and schematics were created in Adobe Illustrator.

Creating new durability attributes for MaterialUniverse also required some literature reviewing, but a large proportion of time was spent finding credible sources for data collection. This was then used to assign ratings for new galling resistance and stress corrosion cracking attributes for

metals, for which some familiarity with alloy compositions was very useful. Again, simple explanations using material knowledge and research were written.

Due to the large amount of research undertaken, I became an expert on these areas relative to supervisors and other colleagues, so it was often necessary to articulate the significance of findings and use existing knowledge to answer questions.

Despite having never come across any of these areas and had little experience of how the software works, my supervisors were very approachable and all projects were very successful. I would highly recommend internships at this company.

Report 4

1. General

Placement Location: **Granta Design**
Arrival and Departure Dates: **1st July – 26th September**
No. of working days spent at Institution: **64 (just under 13 weeks)**

2. Financial

Where did you stay during your placement (town name)?: **Cambridge (college accommodation)**
Total cost of daily travel to and from Institution (£): **Free**
Total received from Institution (£): **£3578**

3. Research Project

Title of Research Project: **New Records for MaterialUniverse**
Written Report submitted to host institution?: **yes**
Experimental Techniques used: **N/A**
Interest level of project: on a scale of 1 (low) to 10(high): **7**
Quality of support provided: on a scale of 1 (low) to 10 (high): **9**
Interaction with other researchers: on a scale of 1 (low) to 10 (high): **6**

Short summary (~ 200 words) of technical content of project:

The work was focused on creating new material records for the Granta Design software – CES EduPack and MaterialUniverse. This involved analyzing data for various materials (the focus was on steels and rare earth magnets), summarizing the information on the material properties and then determining which new records should be created. The internship also involved VBA programming in Excel, creating a template which would help with the required data analysis and import of new records. The creation of the template was not initially part of the summer project, but it became the main focus of my work as the summer progressed and the team realized how it could be helpful in the future.

All the work was computer based with the majority of the time spent using Excel. Any research carried out used reference databases and supplier websites (eg manufacturers of steels and magnets).

Report 5

1. General

Placement Location: **Granta Design**
Arrival and Departure Dates: **1st July – 26th September**

No. of working days spent at Institution: **58**

2. Financial
Where did you stay during your placement (town name)?: **Cambridge (college accommodation)**
Total cost of daily travel to and from Institution (£): **Free**
Total received from Institution (£): **-**

3. Research Project
Title of Research Project: **Data for Circularity Indicators**
Written Report submitted to host institution?: **yes**
Experimental Techniques used: **Google, Web of Science, Excel, Python**
Interest level of project: on a scale of 1 (low) to 10(high): **7**
Quality of support provided: on a scale of 1 (low) to 10 (high): **7**
Interaction with other researchers: on a scale of 1 (low) to 10 (high): **4**

Short summary (~ 200 words) of technical content of project:

The Data for Circularity Indicators project was focused on researching available data on three different factors for a wide variety of materials. First I worked on finding the recycling process efficiency of materials, which is defined as the percentage of material recoverable through recycling using current technology, ignoring losses from material which is not collected. Secondly, I worked on finding data for the pricing variability of materials, trying to find historical pricing data giving a monthly average for the past five years. This consumed most of my time, and I used a number of tools to accomplish this, including an extensive analysis of the UN Comtrade import/export database using statistical techniques and the Python programming language. This took longer than expected, and as a result I did not begin work on the third portion of my project, researching the material composition of various electrical and electronic components.

Frazer-Nash Consultancy, Dorking, Surrey

1. General
Placement Location: **Frazer-Nash Consultancy**
Arrival and Departure Dates: **Monday July 7th – Friday September 12th**
No. of working days spent at Institution: **45 (10 week placement with 5 days holiday)**

2. Financial
Where did you stay during your placement (town name)?: **Effingham (living with a company employee)**
Total cost of daily travel to and from Institution (£): **Zero, I cycled and was also able to get a lift from the company employee who I was living with**
Total received from Institution (£): **£325 per week, plus the first two weeks of accommodation were paid for by the company**

3. Research Project
Title of Research Project: **Consultancy - Variety of projects**
Written Report submitted to host institution?: **Various reports as part of individual projects**
Experimental Techniques used: **None**
Interest level of project: on a scale of 1 (low) to 10(high): **9**
Quality of support provided: on a scale of 1 (low) to 10 (high): **10**
Interaction with other researchers: on a scale of 1 (low) to 10 (high): **10**

Short summary (~ 200 words) of technical content of project:

I took part in a few different projects, below is quick summary of the technical content of each project:

- **I wrote a literature review on rubber degradation models.**

- **I worked a lot with the Abaqus and ANSYS finite element analysis programmes trying to model the creep of Nickel superalloys in gas turbines. I wrote a usercreep subroutine for ANSYS, this allowed us to use our own custom creep law within the ANSYS programme. I then did a lot of testing of the creep law in ANSYS; initially on a single element model, comparing the ANSYS results with the exact creep equations in Excel. I also made identical models of a square plate with a central hole in both Abaqus and ANSYS, and then used these to compare the ANSYS creep routine I had made with a pre-existing routine based on the same creep equations but written for Abaqus. After passing this testing I additionally trialed the creep routine on an actual gas turbine disk model in ANSYS.**

- **I fitted a ductility model to creep and tensile ductility data for a range of superalloys in Excel.**

- **I looked Larsson-Miller Parameter (LMP) vs Stress curves fitted to data for various superalloys. I focused on the behavior of the fitted curves at extreme high and low stress values, looking for inconsistencies in the model.**

- **I investigated the effects of changing the creep law parameters for an ANSYS input file that someone else had made. I looked at the effects of the creep constants on stress redistribution in the body as it creeped.**

Johnson Matthey (Noble Metals), Royston, Herts.

1. General
Placement Location: **Johnson Matthey**
Arrival and Departure Dates: **8/7/14 to 12/9/14**
No. of working days spent at Institution: **49**

2. Financial
Where did you stay during your placement (town name)?: **Cambridge**
Total cost of daily travel to and from Institution (£): **£268**
Total received from Institution (£): **£ 3341.58**

3. Research Project
Title of Research Project: **The Manufacture of Grain Stabilised Rhodium**
Written Report submitted to host institution?: **Yes**
Experimental Techniques used: **Scanning Electron Microscope; optical microscope; Malvern Laser Diffractometer; X-ray diffractometer; compression testing; mixing equipment such as Turbula mixer and ball mill; laboratory techniques such as filtration, dissolution, etching; sintering in furnace; familiarization of processing stages such as powder pressing, forging, rolling**

Interest level of project: on a scale of 1 (low) to 10(high): **9**

Quality of support provided: on a scale of 1 (low) to 10 (high): **10**
Interaction with other researchers: on a scale of 1 (low) to 10 (high): **9**

Short summary (~ 200 words) of technical content of project:

My project involved developing a powder processing route to manufacture grain stabilized rhodium (GS Rh) for use in a common appliance. The powder processing route comprises of mixing Rh and ceramic powder to form a distribution of the ceramic throughout the Rh. The ceramic particles inhibit grain boundary motion resulting in a material with theoretically improved wear characteristics compared to the material currently used. After mixing, the powder is pressed, sintered, forged then rolled to form a metal sheet. The majority of my report focusses on the first stage: mixing. I conducted a series of experiments to determine the optimum mixing conditions to produce a homogeneous ceramic distribution through the Rh. Parameters such as mixing method (Turbula mixing and ball milling), mixing time, mixing speed, milling ball material and dispersant were varied. The resulting mixture was analysed using Scanning Electron Microscope images, powder density measurements and a laser particle sizer to determine the conditions resulting in the best mixture to produce GS Rh.