

European Vacation Placements: Reports 2022

Below are reports on the Summer Placements provided by students who participated in the scheme in 2022.

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ETH, Zurich, Switzerland

1. General		
Placement Location	Zurich, Switzerland	
Arrival and Departure Dates	11.07.22-17.09.22	
No. of working days spent at Institution	39	
2. Financial		
Cost and method of return travel from the UK (£)	Plane, 96£	
Total cost of daily travel to and from Institution	180 CHF (two monthly tickets for all public transport in Zurich were purchased)	
Total cost of accommodation (say if provided free)	I stayed with family (for free)	
Value of Armourers & Brasiers bursary	860£	
Total received from College		
Total received from Institution	1100 CHF	
3. Accommodation		
Accommodation address	N/A	
Type of Accommodation	Own family apartment	
Distance from Institution	N/A	
Quality of accommodation	on a scale of 1 (low) to 10 (high)	N/A
Quality of facilities	on a scale of 1 (low) to 10 (high)	N/A
Convenience of location	on a scale of 1 (low) to 10 (high)	N/A
4. Research Project		
Title of Research Project	Synthesis and smoothening of raspberry particles	
Written Report submitted to host institution	Yes	
Experimental Techniques used:	Synthesis involved: injections, different agitation methods. Results were checked with: Fluorescence microscopy, AFM, (SEM images were taken by my supervisor)	
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)	9
Interaction with other researchers	on a scale of 1 (low) to 10(high)	10
Short summary (~ 200 words) of technical content of project:		
The goal of the project was to find a method to smoothen rough silica raspberry particles by coating them in further layers of silica to achieve smooth spherical particles. This is of interest, as fluorescent markers can be attached in the rough particle stage and smoothened out, which allows us to track smooth particle rotation.		

Raspberry particles with different sized asperities were synthesized by creating silica core particles via the Stöber process which are grown to the desired size through silane and ammonia injections. The particles are then functionalized using a positively charged polymer (PolyDADMAC). Then small commercial silica particles, “berries” of different sizes can be attached to the (now positive) core through electrostatic attraction. These raspberry particles are coated in a thin layer of silica to covalently bond the berries to the core particles.

Smoothing of raspberry particles is achieved through repeated silane injections into a particle-base mixture under vigorous agitation (stirring and ultra-sonication). The particles are washed between injections and centrifuged at particle-size-specific rates to remove secondary particles formed.

Progress of the smoothing process was checked using SEM and the roughness of the colloids was characterized by AFM.

EPFL, Lausanne, Switzerland

1. General		
Placement Location	Lausanne, Switzerland	
Arrival and Departure Dates	09 July to 05 September	
No. of working days spent at Institution	40 days	
2. Financial		
Cost and method of return travel from the UK (£)	Flights and Luggage £180	
Total cost of daily travel to and from Institution	Lausanne travel card £53 per month	
Total cost of accommodation (say if provided free)	£710 pm	
Value of Armourers & Brasiers bursary	£500	
Total received from College		
Total received from Institution	CHF 1600 minus the value of the A&B bursary	
3. Accommodation		
Accommodation address	Route Cantonale 35, St Sulpice, 1025	
Type of Accommodation	Student accommodation, sub-let from current EPFL student who was away for the summer	
Distance from Institution	5 minute walk away	
Quality of accommodation	on a scale of 1 (low) to 10 (high)	8
Quality of facilities	on a scale of 1 (low) to 10 (high)	8
Convenience of location	on a scale of 1 (low) to 10 (high)	10
4. Research Project		
Title of Research Project	SuNMIL’s research focusses on antiviral technology and proteins for novel drug delivery techniques.	
Written Report submitted to host institution	Yes	
Experimental Techniques used:		
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)	9
Interaction with other researchers	on a scale of 1 (low) to 10(high)	7
Short summary (~ 200 words) of technical content of project:		
Unable to share the detail of the project due to confidentiality arrangements.		

TUHH, Hamburg, Germany

1. General		
Placement Location	TUHH, Hamburg, Germany	
Arrival and Departure Dates	01.07.2022 to 31.08.2022	
No. of working days spent at Institution	43	
2. Financial		
Cost and method of return travel from the UK (£)	Flights £178.67	
Total cost of daily travel to and from Institution	Free (short walk)	
Total cost of accommodation (say if provided free)	900 Euros (450 per month) plus a 60 Euro cleaning fee for a total of 960 Euros	
Value of Armourers & Brasiers bursary	£1420	
Total received from College	0 (the college Finance Office wanted to see the amount awarded by the Armourers and Brasiers Company before awarding any funding, and decided I was adequately funded).	
Total received from Institution	600 Euros	
3. Accommodation		
Accommodation address	NIT apartments, 12 Kasernenstraße, 21073 Hamburg	
Type of Accommodation	Single bedroom student apartment with ensuite and kitchenette	
Distance from Institution	Around 400 meters	
Quality of accommodation	on a scale of 1 (low) to 10 (high)	8
Quality of facilities	on a scale of 1 (low) to 10 (high)	8
Convenience of location	on a scale of 1 (low) to 10 (high)	10
4. Research Project		
Title of Research Project	Additive manufacture of inverse photonic structures	
Written Report submitted to host institution	yes	
Experimental Techniques used:	Centrifuge, ultrasonic bath, SEM microscope, custom made direct writing equipment, commercial 3d printer	
Interest level of project	on a scale of 1 (low) to 10(high)	6
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)	8

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

The aim of the project was to form inverse photonic structures of silica, consisting of multiple printed layers. This was to be done by using a custom-made direct writing equipment to form colloidal structures of micro-scale PS (polystyrene) particles, which were infiltrated in a TEOS (Tetraethyl orthosilicate) solution, in a single step.

Previously this had been carried out in two separate steps. The TEOS is in a solution with Hydrochloric acid and ethanol and undergoes a “sol-gel” reaction to form silica. The PS particles are then burnt off in a furnace to leave the desired structure.

Previous work had been done in optimizing the parameters using the custom-made equipment with suspensions of just PS particles in water. My role was to continue this work with the new suspensions.

First, I recreated results from previous work using cheaper equipment to cut down costs. Here, I also learnt to use the commercial printer. But the functions did not suit our goals so we moved on to the custom equipment.

Then, I optimized the printing parameters to form lines with the new suspension, before moving on to complete 1cm² surfaces and then began working on a second layer.

In order to optimize the parameters for the printer as well as the concentration of solution for the best results, I needed to analyze my results in a SEM (Scanning electron microscope).

I also learnt to write code for both the commercial, and custom printers.

Rolls-Royce Deutschland, Germany

1. General	
Placement Location	Rolls-Royce Deutschland – Dahlewitz, Berlin
Arrival and Departure Dates	16th July to 25th September 2022
No. of working days spent at Institution	50
2. Financial	
Cost and method of return travel from the UK (£)	Flights (EasyJet, LGW – BER) Outbound: £39.99 Inbound: £32.84 Hold Bag: £61.48 Bicycle: £90 Total: £215.31 (the idea was to commute using my bike and therefore save on train passes, costing €90 per month)
Total cost of daily travel to and from Institution	£0 (cycled to work) I spent about €200 total on trips to other parts of Germany (visiting friends in Augsburg and Munich), and occasional public transport use in Berlin.
Total cost of accommodation (say if provided free)	€650 per month for 2.5 months = €1625 (a €650 deposit was required)
Value of Armourers & Brasiers bursary	£1090
Total received from College	

Total received from Institution	€2000	
3. Accommodation		
Accommodation address	Kaiser-Wilhelm Strasse 44, 12247 Berlin	
Type of Accommodation	Apartment 4 person flat-share in Lankwitz, Berlin Found using wg-gesucht.com	
Distance from Institution	22km cycle	
Quality of accommodation	on a scale of 1 (low) to 10 (high)	8
Quality of facilities	on a scale of 1 (low) to 10 (high)	8
Convenience of location	on a scale of 1 (low) to 10 (high)	5 (struggled to find anything closer, though)
4. Research Project		
Title of Research Project	New Overspeed Methods: Application of fracture mechanics to burst integrity assessments	
Written Report submitted to host institution	Yes	
Experimental Techniques used:	Finite Element Analysis (ABAQUS) + Scripting using Python Uniaxial and biaxial tensile testing (not carried out by me personally, but a crucial part of the project)	
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)	7
Interaction with other researchers	on a scale of 1 (low) to 10(high)	8
Short summary (~ 200 words) of technical content of project:		
<p>New Overspeed Methods: Application of Fracture Mechanics to Turbine-Disk Overspeed Integrity Assessments</p> <p>When certifying a new engine, regulators require that all critical rotating parts survive an ‘overspeed’ test, in which they spin faster than rated for a brief period. Currently this is done by means of a ‘rig test’ where a production-similar disk is spun until it bursts. The project aims to develop a new method to replace the expensive (~€500k/test) rig tests with simple tensile tests on fracture-mechanics specimens.</p> <p>Method: A finite element model of the disk is analyzed to determine the most critical regions. Cracks are inserted at these regions and the analysis is rerun. Constraint factors (J-integral, peak stress triaxiality) are measured at the crack A notched tensile specimen is designed with matching constraints Run tensile test on specimens to produce Failure Assessment Diagram (FAD)</p>		

Helmholtz-Zentrum Hereon, Geesthacht, Germany

1. General		
Placement Location	HZH Geesthacht, Germany	
Arrival and Departure Dates	1/8/22 – 28/9/22	
No. of working days spent at Institution	42	
2. Financial		

Cost and method of return travel from the UK (£)	Flight to the Netherlands (London Stanstead to Maastricht), train to Germany, direct return flight (Hamburg to London Stanstead) £160	
Total cost of daily travel to and from Institution	£0	
Total cost of accommodation (say if provided free)	£543	
Value of Armourers & Brasiers bursary	£560	
Total received from College	£200	
Total received from Institution	£1,515	
3. Accommodation		
Accommodation address	Otto-Hahn Strasse 1, Geesthacht 21502, Germany	
Type of Accommodation	Shared Guesthouse (ensuite room, shared kitchen and living room)	
Distance from Institution	8 minute walk	
Quality of accommodation	on a scale of 1 (low) to 10 (high)	9
Quality of facilities	on a scale of 1 (low) to 10 (high)	8
Convenience of location	on a scale of 1 (low) to 10 (high)	8 (very easy to get to work, quite far from centre of Geesthacht)
4. Research Project		
Title of Research Project	In-situ Synchrotron Radiation Diffraction Study of Compression of AZ91 Composites Reinforced with Recycled Carbon Fibres	
Written Report submitted to host institution	Yes, and paper submitted to journal Crystals	
Experimental Techniques used:	Synchrotron diffraction, compression tests, microscopy	
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:		
<p>Lightweight structural materials are increasingly sought after in the automotive and aerospace industries for their potential to improve fuel efficiency. Magnesium based metal-matrix composites are a potential candidate for these kind of applications. The use of recycled carbon-fibres offers further energy and cost savings. The compressive deformation mechanisms of extruded, heat-treated recycled carbon fibre composites compared to AZ91 were investigated using in-situ synchrotron radiation diffraction. The composites were manufactured by stir casting with high dispersion shearing. An increase in ultimate compressive strength was achieved in the composites compared to AZ91. The deformation mechanisms active in the composites were similar to those in AZ91. Magnesium alloys in compression typically show extensive twinning, this was observed in AZ91 and the AZ91 composites. The stress required for twinning onset was increased in the composites and the twin volume fraction at failure was decreased compared to AZ91.</p>		

MUL, Leoben, Austria

1. General		
Placement Location	MUL (Erich Schmidt Institute), Leoben, Austria	
Arrival and Departure Dates	18/07/2022 – 8/09/2022	
No. of working days spent at Institution	39	
2. Financial		
Cost and method of return travel from the UK (£)	£170.98, then ~£45 – Return flights (LGW to VIE) and train (Vienna airport to Leoben and back). I also stayed in Vienna for a night on the way so paid that hotel cost. Train tickets were half price by paying €19 for a Vorteils card Jugend, would recommend!	
Total cost of daily travel to and from Institution	£0 – borrowed bike at institute via an email ad	
Total cost of accommodation (say if provided free)	€862.91 + €500 deposit	
Value of Armourers & Brasiers bursary	£1020.00	
Total received from College	£0	
Total received from Institution	€3377.26 → £2820.44 after health/local tax	
3. Accommodation		
Accommodation address	Living Campus Kreuzfeldweg 3 Leoben, 8700	
Type of Accommodation	Student 1 room apartment	
Distance from Institution	20 mins walk/10 min cycle	
Quality of accommodation	on a scale of 1 (low) to 10 (high)	8
Quality of facilities	on a scale of 1 (low) to 10 (high)	8
Convenience of location	on a scale of 1 (low) to 10 (high)	7
4. Research Project		
Title of Research Project	Hardness and Thermal Stability of CuZr alloys produced by HPT	
Written Report submitted to host institution	Yes, but primarily oral presentation	
Experimental Techniques used:	High Pressure Torsion (HPT), Vickers hardness testing, Optical microscopy (+ sample preparation for each)	
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)	9
Interaction with other researchers	on a scale of 1 (low) to 10(high)	8
Short summary (~ 200 words) of technical content of project:		
The preprepared powder compacted discs of 3 different CuZr based alloys were deformed using HPT to produce a nanocrystalline structure in the outermost radial region of the discs. These were then cut into a semicircular and 4 eighth pieces. The eighths were heat treated at 100 °C intervals from 100-800 °C then polished to allow Vickers hardness measurements to be taken using 30 indent arrays in the outermost radial region of each sample. The data was used to produce a treatment temperature vs hardness plot for the three alloys and an undoped CuZr sample demonstrating the general hardness trends. This plot		

demonstrated the boron samples were the ones stable to the highest temperature so the most promising alloy to pursue further testing with. SEM images of a couple of the samples were taken to directly measure grain size.

A literature review was carried out to collect as much relevant thermodynamic data as possible and identify the criteria for finding a useful dopant. Furthermore, a digitization project and proofreading tasks were undertaken alongside the main project. Various other machines and techniques were demonstrated in use on other projects when time allowed.