Addendum to *SSR in Practice* article 'Discover career paths in materials science and engineering' by Chris Hamlett and Becky Waldram (*SSR in Practice*, 106 (392), 30–32)

Career profiles in materials science and engineering (MSE)

Ella Podmore MBE, McLaren Automotive Ltd

Ella's role

Ella is responsible for most metallic-related investigations within the business, specialising in metallurgy and surface treatments. Her work involves the failure analysis of development components on future models, material characterisation of new materials, management and distribution of material property data to engineering departments across the business and creation of new material roadmaps. Her role is heavily lab-based, using analytical techniques previously learnt at university and working towards enhancing the manufacturing firm by creating a high-performance product.

Career pathway

Ella studied a Masters of Materials Engineering at the University of Manchester, where she completed an engineering placement at McLaren Automotive during her third year. After a successful 12 months she returned to university, working on a dissertation topic for the company. After the completion of this final-year project, McLaren Automotive invited her back as their materials engineer permanently in 2018 and she has since been leading metallic-related investigations for all projects.

Skills needed for the role

Technical skills such as metallic fractography, material manufacturing and processing techniques, an understanding of metallic microstructures and characterisation data of alloys are important. The ability to clearly communicate complex scientific findings to people outside the technical field is paramount. On top of this, a level of business understanding or skills in project management will make a successful materials engineer in this industry.

Belinda (Bee) Rich, Swinburne University of Technology, Melbourne, Australia

Bee's role

Bee is a research assistant and PhD student at Swinburne University of Technology in Melbourne, Australia. She works in the Extra-Terrestrial Resource Processing group of the university's High Temperature Processing lab, meaning she uses high-temperature equipment like furnaces to develop and carry out research on projects ranging from lunar rover design to eco-friendly steel. Her main PhD work is funded by partner Lunar Resources Inc., a US-based space start-up, who have tasked Bee with designing and developing a casting system for manufacturing metal wire on the surface of the Moon. With plans from NASA and other space agencies to develop permanent lunar bases, in-space manufacturing is an important field of research; the aim is to one day make everything we need for extra-terrestrial living *in situ* without having to launch it from Earth. Bee's

casting system will also hopefully make it to the Moon one day, where it will enable astronauts to make their own electrical wire or 3D printer feedstock out of lunar dust. Bee's day-to-day work in a metallurgy lab often involves handling molten metals at temperatures over 1500 °C, looking at samples under the scanning electron microscope, or using specialist equipment to measure material properties. She also spends time outside the lab working on multi-physics computer models, designing her casting system using CAD, and working as a teaching assistant for the undergraduate engineering course.

Sampling steel in the induction furnace at 1630 °C

Career pathway

After completing A-levels in physics, maths and chemistry, Bee studied an integrated MEng Materials Engineering with Industrial Experience degree at the University of Birmingham, where she developed a love for metallurgy while completing a six-month placement with Tata Steel. Her love for space came after her degree, when she moved to the Netherlands to complete a graduate traineeship on space habitats with the European Space Agency. Here, she worked on conceptual projects such as lunar cement made from Moon dust and astronaut urine! Her love of metallurgy and space led her to move to Australia for her current role.

Skills needed for the role

- **Communication** – When you collaborate with people of different backgrounds from all around the world, it is important to be able to communicate complex ideas in an effective way.
- **Creativity** – In space research, the challenges faced are completely different to those we face on Earth. Lateral and creative thinking are necessary to come up with new approaches to unexplored problems.
- **Critical thinking** – Experimental work creates a lot of data, but analysing data is where the real science comes into play. Critical thinking improves our analysis by allowing us to evaluate our assumptions and biases to come to the most accurate conclusion.
- **Adaptability and resilience** – Sometimes things go wrong, or you discover a better way to achieve the result you need. The best researchers are open to learning new skills and willing to keep trying when the experiment fails.

Alexander Dhesi, Expedition Engineering Limited and Useful Projects

Alex's role

As Sustainability and Materials Innovation Consultant, Alex is responsible for whole-life carbon assessment (WLCA) and circular economy strategy for buildings and masterplans, organisational carbon footprints, and materials research and innovation. He is particularly interested in direct reuse of building materials, and industrialised re-manufacture ('upcycling' as opposed to recycling or downcycling).

Career pathway

After taking A-levels in mathematics, chemistry, physics and English literature, Alex took an undergraduate degree in MSE, followed by an MSc at Imperial College London in Materials for Sustainable Infrastructure. The UK construction sector is responsible for 60% of material use and waste generation: reducing the environmental impact of urban development through improved design, materials selection and reuse is a key priority for reaching net zero and driving innovation worldwide.

What did you enjoy most about your MSE course?

Phase diagrams! Just kidding. My undergraduate dissertation investigated the use of lignin (a carbon-dense material found in plant matter) in the production of carbon fibre for composite materials. Adapting existing production methods for a highly variable biobased raw material was both challenging and rewarding!

Career highlights

The coolest thing was developing a circular materials reuse strategy for various buildings scheduled for deconstruction in London. Despite the technical and commercial challenges of materials reuse, clients are becoming more and more interested in the circular economy concept, and I hope we will see some of these opportunities through to a new construction containing reused components.

What is your favourite material (and why)?

Any material that has already been manufactured into a construction product (have you spotted a theme yet?). Existing stocks of materials and components represent a hugely underutilised asset for future development while minimising raw material extraction and the associated environmental impacts.

What advice would you give your 16-year-old self?

Don't worry about not having your education and career plans figured out, almost nobody does. Also, spend more time on maths.