A role model in research and development

In the field of science and technology, Professor Alison Emslie Lewis, who heads up the Department of Chemical Engineering at the University of Cape Town (UCT), is a top achiever who has dedicated most of her academic career to research and development. Debbie Besseling spoke to this 2012 Women in Science Award winner about her significant contribution to the development of science in South Africa.

Tell us about work and projects undertaken in the Crystallisation and Precipitation Research Unit in the Department of Chemical Engineering at UCT?

The Crystallisation and Precipitation Research Unit is hosted by the Department of Chemical Engineering, which falls within the Faculty of Engineering and the Built Environment. The aim of the research unit is to advance existing fundamental knowledge in the fields of crystallisation and precipitation. Since precipitation processes are currently very empirically based, we are continuously working on improving the scientific understanding of these processes for scale-up, optimisation and control. Our research is mainly concerned with projects related to the mineral processing industry. Specific projects involve improving the precipitation of platinum, rhodium, nickel, copper, cobalt, iron, magnesium and calcium, but we also have many projects that focus on water-related issues.

Briefly tell us about your PhD?

I completed my PhD in 1993. I was lucky enough to have two A-rated scientists (and great people) as supervisors for my PhD. Prof. George A Ekama, who is a well known civil engineer and Prof. BD (Daya) Reddy, who is an applied mathematician. My PhD was therefore a combination of both civil engineering and applied mathematics.

What would you like to highlight as some of the successes of your career?

I've had a very traditional academic career. I did an undergraduate chemical engineering degree, which was followed by a Masters in chemical engineering, that was very much focused on mathematics and mathematical simulation. In between, I worked for a couple of years as a process engineer for South African Nylon Spinners. I returned to do a PhD in mathematical modelling for biological systems. Thereafter, I did a post-doctorate with Prof. Ekama for a year-and-a-half and was then appointed to my academic job in chemical engineering. In summary, my career has therefore been very much as an academic, except for the brief period that I spent in industry.

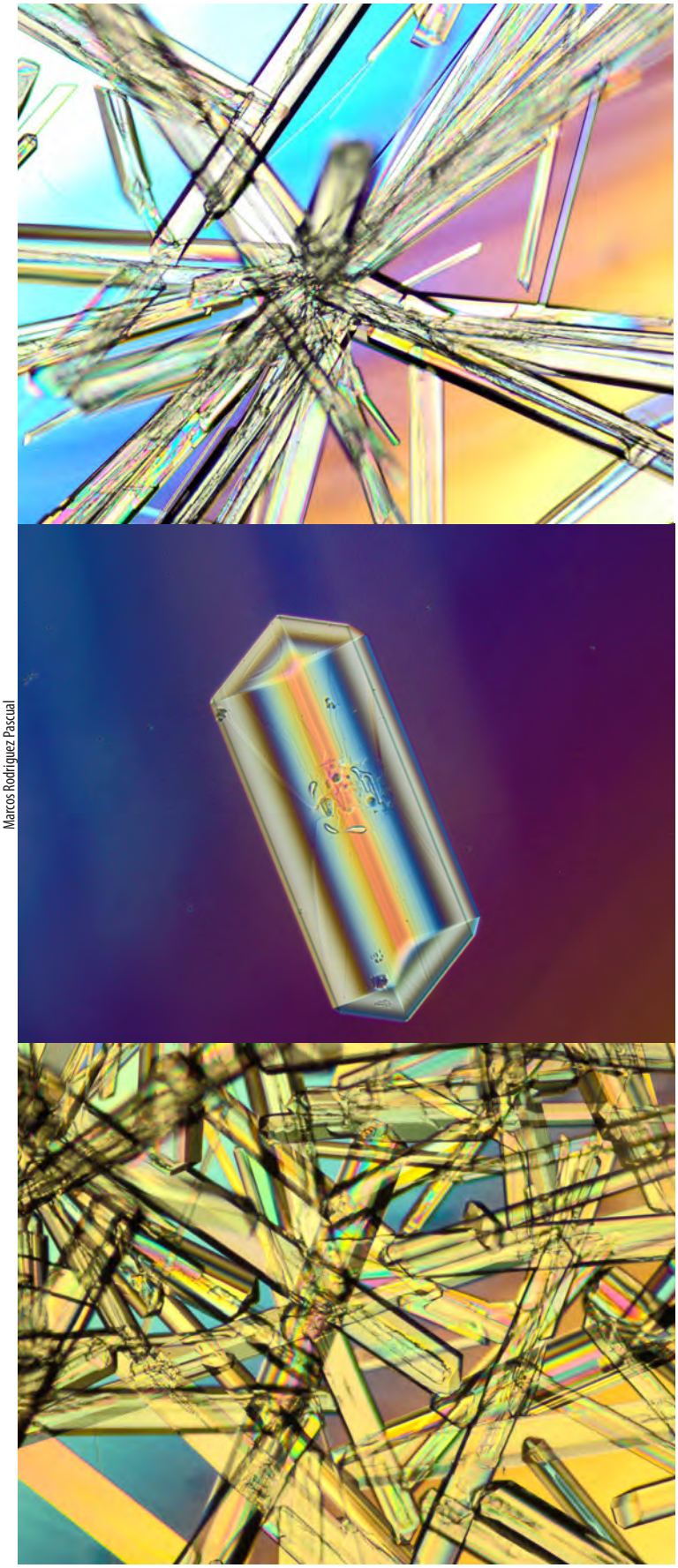
The Women in Science Award for 'Distinguished Woman in Physical and Engineering Science' was the latest of a string of awards. Tell us about the others?

Other awards include the 'Highly Commended' Certificate, British IChemE Sustainable Technology Award, for the project on eutectic freeze crystallisation for treatment of hypersaline brines (won in 2010), and the National Research Foundation (NRF) President's Award for 'Champion of transformation in research' (2010). In 2009, I achieved a B2 NRF rating .

If we talk about innovation and research in the water sector, what are some of the projects that the Crystallisation and Precipitation Research Unit has been involved in?

I have always had an interest in both environmental and water issues, which is why I pursued water treatment subjects in my post-graduate degrees. However, when I started the research unit, I was told that it would be difficult to get funding for research in water and was advised to undertake research on the actual processes involved. As a result I got involved in research in

Some of the crystals created by the Crystallisation and Precipitation Research Unit.



Marcos Rodriguez Pascual

platinum and rhodium precipitation and crystallisation, but always kept an interest in water treatment alive, mostly through projects related to the treatment of acid mine drainage.The topic of water treatment has been a constant theme through the research that I've been involved in.

Then, in 2007, we started our work in eutectic freeze crystallisation, which is a novel technology for treating acid mine drainage and hyper-saline brines. That has been a very exciting innovation in water research in our laboratory.

Tell us about the work of some of your students?

There have been a range of students that I have worked with and they are all special in what they have accomplished. In the early days (early 2000s), crystallisation and precipitation was a new research area in this department. Those early students probably taught me more than I taught them, but we learnt together in this field.

Jeeten Nathoowas was one of those students, and his work was on the topic of crystallisation in membranes during water treatment. Another student that I would like to mention was Shilpa Seewoo, whose work was on morphology control in gypsum precipitation. There are so many other projects that I could mention, quite a few of them in the field of water treatment.

There have been a number of PhDs that I would like to highlight, namely Freenman Ntuli, whose work focused on the mechanisms of precipitation in the reduction of nickel via hydrogen and, Mfandaidza Hove – iron precipitation in acid mine drainage. Both of these PhDs graduated in 2008.

More recently, there have been projects in the field of eutectic freeze crystallisation as well as projects in precipitation of sparing soluble salts, which is relevant for the removal of metals from acid mine drainage.

Courtesy UCT

*Top: Prof Alison Lewis surrounded by her students and **above:** students working in the lab.*

"We all have a moral and ethical imperative to contribute to the development of our country."

What is your message to students entering the field of civil engineering or chemical engineering?

Minister of Science and Technology, Derek Hanekom, who spoke at the UCT Engineering and the Built Environment graduation ceremony earlier this year, highlighted how the country needs qualified engineers. We all have a moral and ethical imperative to contribute to the development of our country. We also encourage students to pursue post-graduate studies.

What, in your opinion are the challenges that we face in the water sector?

I think there are huge challenges in the water sector. What is interesting is that chemical engineering used to draw a lot of students who were out to get a professional degree and make a good living. Now there is a new a group of students who are committed to using their degrees to solve the pressing global challenges of the day – and one of these is water. There are opportunities and a huge potential for students, graduates and engineers to start getting involved in solving water problems. ❑

About the Crystallisation and Precipitation Research Unit

Industrial crystallisation research was initiated in the Department of Chemical Engineering in 2000 and the Crystallisation and Precipitation Research Unit was formally accredited by the university in 2006. The aim of the Research Unit is to **advance existing fundamental knowledge** in the fields of crystallisation and precipitation, especially related to the South African and international **mineral processing and extractive metallurgy** industries.

Ode to the Crystallisation and Precipitation Research Unit

In my journey so far into crystallisation
I've spent many hours in profound consternation
It's not just a question of molecular organisation
Or local supersaturation; or a simple growth equation

It's the subtle interaction of the crystallising particle
With the fluid, the impeller, and almost any other article,
And the chemistry involved can also be quite frightening
And add to it the fact that the rates are all like lightening.

And even taking measurements can be quite intimidating
Those tiny little particles are incredibly frustrating
And when it's under pressure – how do you find the rate?
And when it's all reacted – well then you are too late.

But when we plot the data and we see a little trend
Or the population balance gives us something to defend
Or we write a little model and amazingly! it fits
Then we can get quite excited at this living by our wits.

We stay up late and work too hard, forget to socialise
In solving all the mysteries of these things that crystallise.

Alison Lewis