Interview: A material curiosity

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Jim Feast talks to Alison Stoddart about polymer science of the past, present and future

Jim Feast CBE is an honorary research professor at both Durham and Eindhoven Universities and president of the Royal Society of Chemistry. His research focuses on the synthesis of polymers and functional materials.

You were recently awarded a CBE for services to polymer science, what inspired you to study polymer science?

It started at Birmingham University in the mid-1960s, after doing a PhD in organofluorine chemistry. I was making fluorinated diene monomers and sending them to our sponsors for polymerisation. But I got no feedback so I took a sample and started doing a few radical polymerisations - it was curiosity really. I found it fascinating that you could take a mobile, colourless fluid and produce a material that had potentially interesting properties.

By the late 1960s, I decided polymer science was what I wanted to do and I went to a meeting in London where the 'great and the good' of polymer science pronounced on its future. They said there was no need for a new polymer for the world's technology, but that we would get all we needed by blending and engineering. This was not good news for someone who had decided to pursue a career in the design and preparation of new polymers. I remember the day well; I thought anyone that can predict the future with that kind of precision has to be daft. But I realised it would be a rocky road getting funding. However, it was what I wanted to do and I was in the university environment, where the one thing you can do is, within reason, what interests you.

How has polymer science changed since the 1960s?

Polymer science has moved on in many ways. Now, we can make functional polymers, for example, polymers with interesting electronic properties including semiconductors and electroluminescence, polymers for delivery of therapeutic agents and, indeed, polymers as therapeutic agents in their own right.

The prediction of the 1960s was in part correct, but they overlooked the impact that engineering plastics would have. They could not have predicted the kind of material properties that Ian Ward, at Leeds University, gets just with simple polyethylene. Polyethylene, suitably processed, is now used for plastic bags, toothbrush handles, human joint replacements and as engineering components of cars and planes.

What part of your research are you most proud of?

"Polyethylene, suitably processed, is now used for plastic bags, toothbrush handles, human joint replacements and as engineering components of cars and planes"
- Jim Feast

My work with John Edwards, which became known as the 'Durham route' to polyacetylene. It was the first time I had been involved with something that attracted the attention and respect of other people in the community. The first time John recovered the polymer, it slowly transformed from an off-white to a black

material via yellow, red and brown. When lumps were broken open, the inside was white and the sequence of colour changes started on the new surfaces. We knew immediately that we had something interesting and we soon learned how to manipulate the process to give films with a silvery appearance. The material was electronically active, a good semiconductor. But we were a bit too soon; the doctrine of 'the right time' belongs to science. The people that could exploit it, the electronics companies, were not communicating well with the chemical industry. Also, it was perhaps not quite the right material but it was a good learning vehicle.

If you were going to go back in the lab now, what would the experiment be?
To make a purely organic magnet. If you put 'organic magnet' into Google you will get an enormous number of hits but people don't publish pictures showing magnetic behaviour and it seems there is not yet a room temperature organic magnet. This is a question I have thought about since I first became a scientist.

What inspired you to become a scientist?
As a child, I was curious and interested in construction toys, making things and nature. At that time, I was eight in 1946, anybody could buy chemicals like calcium carbide and sulphur from their local pharmacy. All of my contemporaries knew how to make a carbide bomb. I think that knowledge has probably disappeared now! We would light sulfur and use the evolved sulfur dioxide to reversibly bleach flowers. It felt like magic.

What was the most groundbreaking discovery in polymer science in the 20th century?
The most important contribution was by Staudinger - he was trying to persuade his contemporaries that polymers differed from the rest of chemicals by being very large molecules, and that was the only difference. Until then, many thought that the properties of rubbers and what we now call polymers were the consequence of ill-defined secondary interactions rather than large molecules that got entangled with each other.

What's the biggest challenge that faces polymer chemists in this century?

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Control of structure, molecular weight and its distribution in linear polymers. Nature can make polymers of specific size and function - but we can't control length with that precision. From an intellectual point of view, achieving this is an important challenge. This, combined with understanding and controlling how polymers self-organise into functional supramolecular structures.

What do you most want to achieve as president of the Royal Society of Chemistry?
The RSC is a good organisation, trying to do valuable things for society - I would like to help it to succeed in those things. That would be sufficient for me. I would like the public in general to perceive the RSC as a group of people acting as a team and working for the benefit of society as a whole, not just for the advancement of themselves.

What's next after being RSC president?
I have always meandered from one thing to the other. I'd like to do something useful and worthwhile - not necessarily on the national or international scene, but something on a local scale. I am keeping an open mind.

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