Issue 10 July 2010

Innovations

Royal Society award for research on material stresses

A researcher whose work helps protect against mechanical failures in aeroplanes has been given a Royal Society award for excellence in science and engineering. Professor Philip Withers from The University of Manchester has received the Armourers and Brasier's Company Prize for his pioneering work using neutron and synchrotron beams to map stresses and image defects across a vast range of materials. The work was carried out at the Science and Technology Facilities Council's ISIS neutron source, STFC-supported light sources including Diamond Light Source and the European Synchrotron Radiation Facility (ESRF) and Institut Laue-Langevin (ILL) which STFC subscribes to for the UK.

Professor Withers' work helps to introduce new manufacturing methods safely and identify potentially catastrophic cases of high stresses or defective materials for engineering components where mechanical failure is unacceptable, such as in aeroplane engines or nuclear materials. His team is regularly invited all over the world to carry out experiments at large facilities including the ISIS neutron source and Diamond Light Source located on the Harwell Science and Innovation Campus and ESRF and ILL in Grenoble.

The Professor of Materials Science and Director of the Henry Moseley X-ray Imaging Facility at The University of Manchester said; "*Through access made available by STFC and EPSRC (Engineering and Physical Sciences Research Council) support we have been able to do some really exciting experiments; for example following the fatigue crack as it grows in three dimensions through the matrix of a aeroengine composite that is bridged by strong ceramic fibres. Besides accelerating the introduction of new technologies and processes, over 40 PhD and post doctoral fellows have also benefitted from carrying out experiments at large facilities.*"

Professor Withers will receive his award on November 30th 2010 along with his colleague at The University of Manchester, Professor Andre Geim, who was awarded the Hughes Medal.

Image Professor Phil Withers: © University Of Manchester

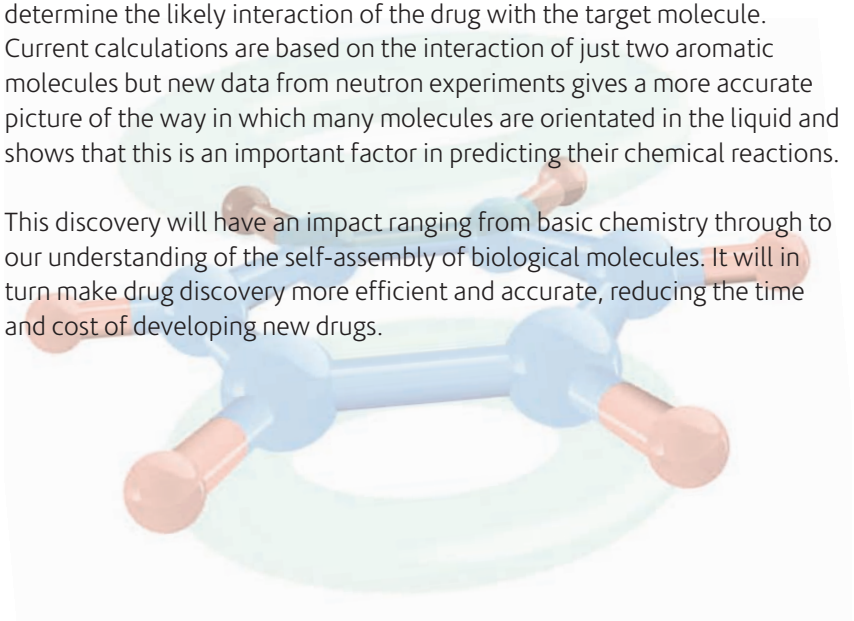
Science & Technology Facilities Council

Breakthrough in development of new drugs - A breakthrough made at STFC's ISIS neutron source could lead to faster and more cost-effective methods of developing new drugs.

Scientists, led by University College London, have demonstrated how aromatic molecules arrange themselves in liquids, which turns out to be more complex than assumed when simulating these effects. Interactions between aromatic molecules - the most famous of which is benzene - are a factor in the way many important biological molecules including DNA and proteins are made up.

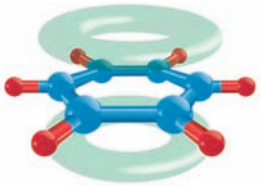
In the early stages of drug design, simulations are frequently used to determine the likely interaction of the drug with the target molecule. Current calculations are based on the interaction of just two aromatic molecules but new data from neutron experiments gives a more accurate picture of the way in which many molecules are orientated in the liquid and shows that this is an important factor in predicting their chemical reactions.

This discovery will have an impact ranging from basic chemistry through to our understanding of the self-assembly of biological molecules. It will in turn make drug discovery more efficient and accurate, reducing the time and cost of developing new drugs.

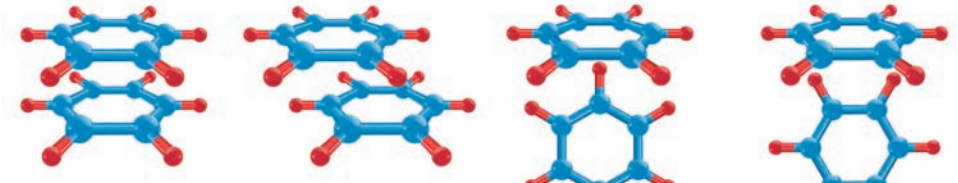


a) Benzene structure

Benzene molecules have a simple ring structure, with a ring of delocalised electrons either side of the molecule. These electron rings affect how benzene molecules are arranged in relation to each other (*hydrogen - red; carbon - blue; electron cloud - green*).



b) Scientists typically visualise benzene interactions via four 'motifs'



Sandwich geometry (S)

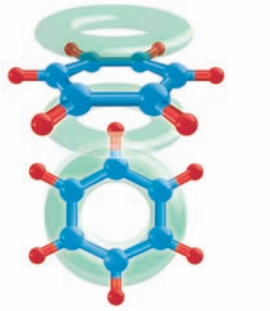
Parallel displaced geometry (PD)

T-shaped geometry (T)

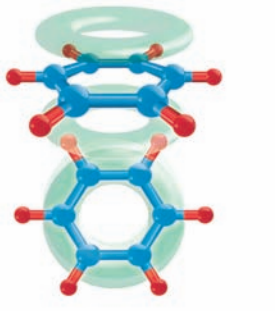
Y-shaped geometry (Y)

c) Difference between T and Y

A slight shift in molecule orientation effects how the benzene molecules interact chemically with other molecules such as proteins. This is because topography is critical



T-shaped (T) has a single hydrogen atom pointing into the centre of the pair benzene molecule.



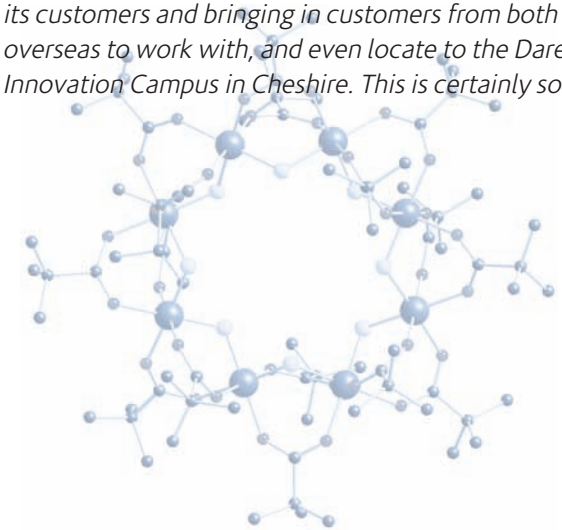
Y-shaped (Y) is slightly rotated so that two hydrogen atoms are pointing to the other molecule's delocalised electron ring. This makes sense chemically as hydrogen atoms have a slight positive charge.

I-TAC is recognised at Chemicals Northwest Awards

The Innovations Technology Access Centre (I-TAC) at the Science and Technology Facilities Council's Daresbury Laboratory has been recognised for its unique and excellent service to start-up business and academic researchers, at the prestigious Chemicals Northwest Awards in Manchester, in May 2010.

Chosen from a host of entries from across the North West, I-TAC was announced the runner up for the Service Provider award. One of nine categories, this award is designed to recognise companies that excel in providing a key service or support function to their chemicals-based customers and who can demonstrate how they had delivered value to their clients.

Andrew Bennett, Daresbury Campus Account Manager at STFC said: *"Although we didn't scoop first prize we are certainly celebrating this achievement. Launched less than six months ago, Daresbury Laboratory's I-TAC has already made its mark on the region, providing a unique service to its customers and bringing in customers from both across the country and overseas to work with, and even locate to the Daresbury Science and Innovation Campus in Cheshire. This is certainly something to be proud of."*



I-TAC represents a significant step-forward in the chemicals sector in the relationship between academic institutions and the commercial world. For the first time, I-TAC allows start-up companies direct and flexible access to the multi-million pound equipment and expertise that has been restricted to top research facilities and world-leaders in industry, revolutionising the future of chemical research and development. I-TAC sits as part of the extended Daresbury Science and Innovation Campus, with access to, among others, STFC Daresbury Laboratory which is known for its world-leading scientific research. I-TAC offers a unique from-concept-to-development service with the campus, offering a home for life policy helping companies grow and expand.

The annual Chemicals Northwest Awards is an opportunity to showcase the region's world-class chemical companies and fly the flag for industry in the UK and attracts a significant number of entrants from across the North West, which is responsible for £10bn chemical industry and employs 55,000 people in the region.

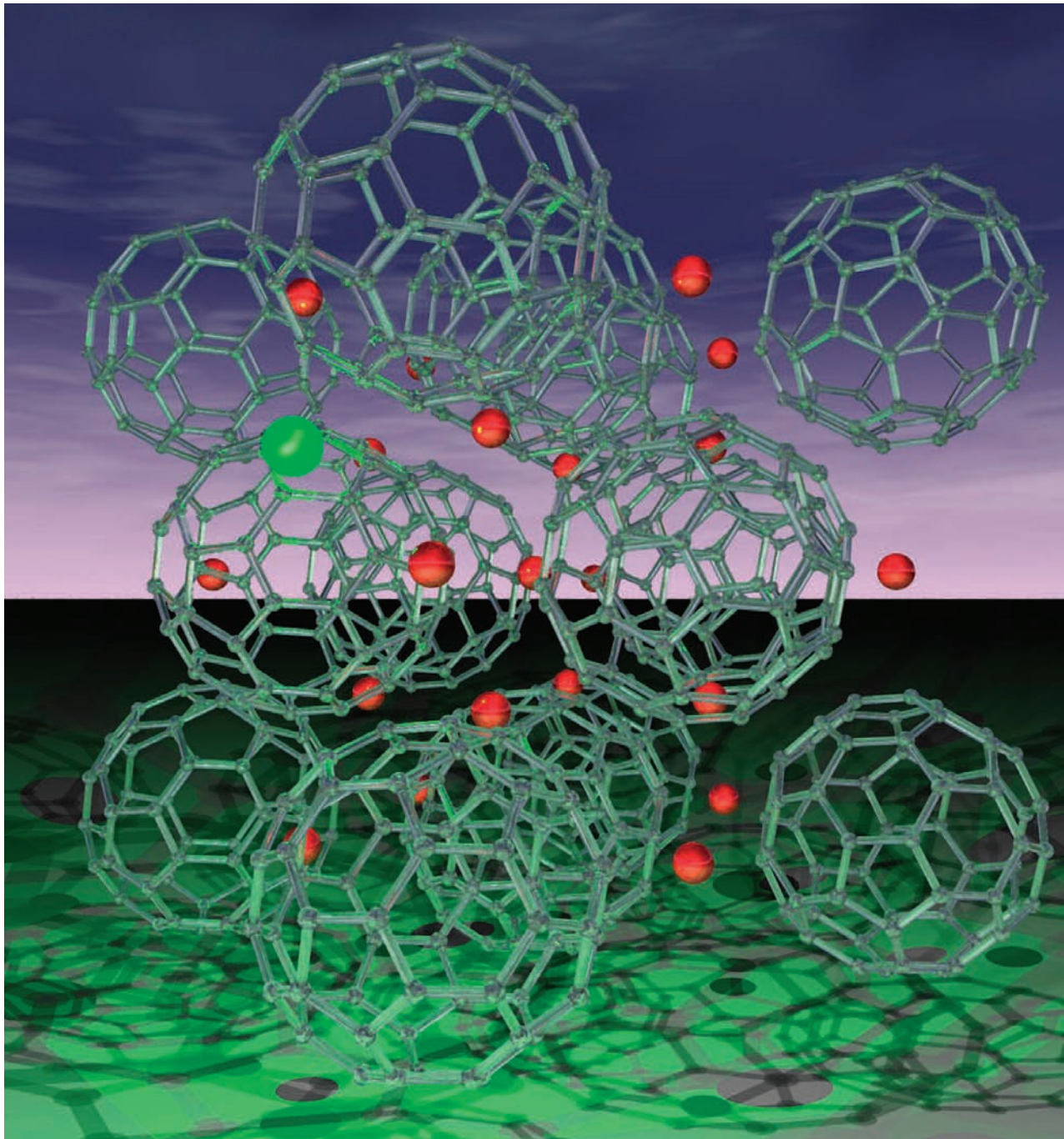
Superconductivity breakthrough could lead to more cost effective technologies

Researchers from the University of Liverpool and Durham University have fitted another piece into the superconductivity puzzle that could help in the quest to bring down the cost of technologies such as MRI scanners and some energy storage applications that rely on superconductors. The result is published in the Nature online journal,19th May 2010.

Using the ISIS and Diamond facilities at STFC's Rutherford Appleton Laboratory (RAL) and the European Synchrotron Radiation Facility (ESRF) in Grenoble, scientists have demonstrated how a new material made from metal atoms and buckyballs (tiny carbon-60 molecules shaped like a football) becomes a high temperature superconductor when it is squashed. The applied pressure shrinks the structure and overcomes the repulsion between the electrons, allowing them to pair up and travel through the material without resistance.

The Liverpool and Durham researchers made the new material supported by funding from the Engineering and Physical Sciences Research Council (EPSRC) for a program investigating ways of creating higher temperature superconductors, to reduce some of the costs involved with keeping them at their optimum temperature and broaden their applications. An MRI scanner for example, contains person-sized superconductive magnet that needs to be kept inside a bath of liquid helium in order to regulate the superconductor's temperature at - 270°C. The ultimate aim is for a superconductor to operate at room temperature to eliminate the need for large and expensive cooling systems. more

Muon implanted into face-centred cubic Cs_3C_{60}

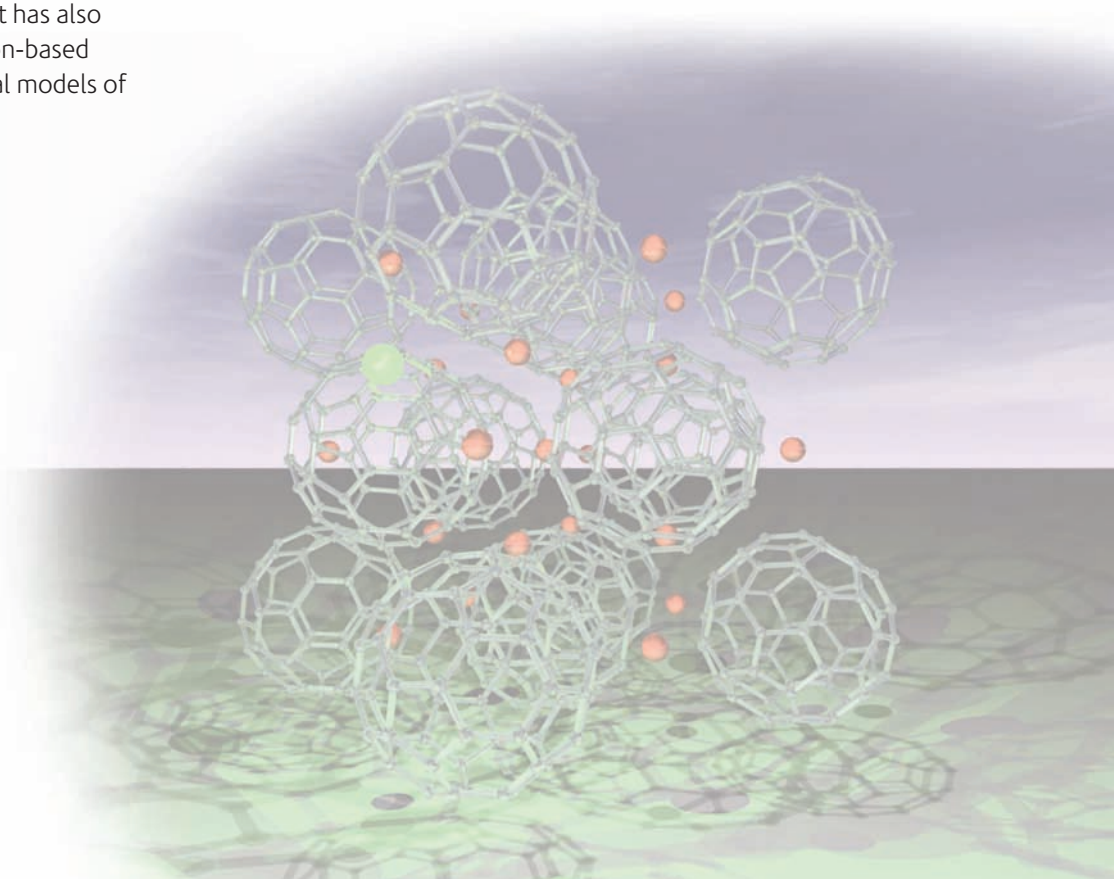


Dr Peter Baker, Muon instrument scientist at STFC's ISIS Facility: "*This research suggests that there is a universal trend in high temperature superconducting materials, which is a great step forward in understanding the fundamental nature of superconductivity. Once we know how superconductivity works it will be easier to develop high temperature superconducting materials with specific properties, opening the door to new applications and ultra efficient energy transmission.*"

The advantage of investigating carbon-based superconducting materials is that they can be made with different structures that alter their properties; whereas the active components of other high high-temperature superconductors, such as copper oxide materials, are always arranged in one way. This structural flexibility offers a new way of looking at the mechanisms that drive high-temperature superconductivity, offering more insight into how to make higher temperature superconductors. It has also established a universal pattern in the superconductivity of carbon-based materials which can now be used to help guide future theoretical models of superconductivity.

Matthew Rosseinsky, Professor of Inorganic Chemistry, University of Liverpool said; "*We've shown for the first time how controlling the arrangement of molecules in a high temperature superconductor controls its properties. This is possible because we have found two arrangements of the same basic molecular unit which have both superconducting and magnetic properties.*"

Kosmas Prassides, Professor of Chemistry, Durham University, said; "*This is important in the context of high-temperature superconductivity as it allowed us to see at which point superconductivity emerges out of the competing insulating state irrespective of the exact atomic structure - something that has not been possible before for any other known material.*"



Anke Lohmann, RSE/STFC Enterprise Fellow wins business competition in Germany

I am currently a fellow on the STFC/RSE Enterprise fellowship scheme and I am exploring the commercialization opportunities for electrospinning from the MNTC at STFC RAL.

Last year I received a newsletter from the TU Dresden (Germany), which included an announcement about the Nano-entrepreneurship – academy (NeNA) in Dresden. The academy is part of an initiative by the German government to increase the number of high tech start-ups in the field of nanotechnology. It is specifically targeted at female scientists, who had been identified as an unexploited source for entrepreneurship in the high tech area.

This caught my interest, because I felt it was a good opportunity to get feedback on my business idea and provide me with information on early stage business funding.

The application process was lengthy. It was online and at one point I nearly gave up when the website crashed and all my data entry was lost. This was followed by a phone interview. Encourage by the positive feedback, I had to draw up two posters: one with the technical details and one for the business proposition. The STFC/RSE enterprise training program helped substantially producing the second poster. With both posters under my arm, I took off to Germany.

Right from the start we had a fully packed program. Arrival on Sunday afternoon, sightseeing tour. In the evening: presentation of our technical work using our first poster. Monday: improvisation workshop. Monday

Anke Lohmann 2nd from the right (in the blue blouse)

evening: presentation of my second poster explaining the business idea. That evening I had to convince at least two participants to join me and I did! I did not have the largest team but I 'recruited' best team: Joanna, Heike and Charlotte.

Tuesday and Wednesday we spent in courses on starting up a business in Germany, how to protect IP, what funding is available etc. In the evenings we had talks from various different female entrepreneurs about the lows and highs of their companies – very similar to what I had learned from the STFC/RSE enterprise course.

On Wednesday night we were finally introduced to our team coach: Michael. He is a venture capitalist and a brilliant coach. He kept us focused on important issues and I learned quite a bit from him. Thursday we spent working on our virtual business. Based on the technology developed at MNTC/STFC, we identified various possible products from which we selected two. Together, we develop our business plan, working it into a 15 min presentation. more

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Friday, the final day and the day to present our business. There were 7 teams in competition. We had to give a 15 min presentation and answer a 20 min question session from a panel of entrepreneurs and scientist. Our's was the final presentation and it went well – we could feel it. The audience was hooked on our story. The questions were easier than we thought and none of them threw us. It was good work!

In the afternoon the competition winner would be announced. We had decided that another group would win. They already were selling a product, they were a lot more experienced than us and they were highly competitive. Yet, against all the odds, we won! And our prize is a three month trip to the US, working in a start up to develop our ideas further.

Why do I think we won: we had a convincing story and we had good, solid team, aided by a brilliant coach. My fellowship did help in providing a firm foundation from which we were able to push ahead. One criticism we received was that we were too conservative in our approach- something for me to think about.

So what is different in Germany when setting up a company? One has to provide? 25K as starting capital to form a GmbH. There is quite substantial financial support from different institutions and funds in Germany, mostly linked to regions. With respect to IP, employees have more rights to own a patent than in the UK.

I am glad I did not give up with my application when the website crashed.

For more information on the scheme, please see

http://www.stfc.ac.uk/KE/FOpp/Fells/EnterpriseFell.aspx