ISIS neutron source is back online

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A team of 60 people worked for six months to install new magnets and beam exit window into the extracted proton beamline of target station. Many of them can be seen here (Credit: Stephen Kill / STFC)

A brand new run of experiments is underway at STFC's ISIS neutron source, from looking at ways of developing new antibiotics, through creating more effective materials in dentistry, to research that could in the future lead to improving the efficiency of electricity transfer in the national grid.

ISIS, a set of 'super-microscopes' that allows us to understand the world

around us at the atomic level, is back online after a six month shutdown period for planned maintenance work. ISIS users include universities and industry as well as STFC's own scientists and engineers.

The following is a selection of work being carried out over the coming months which represents a small proportion of the vast and varied work being carried out at ISIS.

Durable materials for dentistry

An international team is looking at how to improve the quality of selected materials used in dentistry. The Universities of Greenwich and Cambridge and Bangor University are analysing variations of substances known as glass ionomer cements (GICs) which have similar physical properties to bone and teeth, to see if they can be made stronger. GICs are already used to fill teeth but currently, while they are very effective for smaller fillings, they can be too brittle for larger repairs in molars and bone.

By looking at the way the atoms are arranged within the substance using simulations, mechanical testing and neutron spectroscopy, the materials can then be modified to improve performance. This work is being complemented by fracture analysis, medical imaging and other studies to further understanding of GIC compatibility in humans. This latter collaborative work is being carried out by Semmelweis University in Hungary and at the Prince Philip Dental Hospital at the University of Hong Kong.

New antibiotics for tropical diseases

A team from King's College London will be looking at an alternative to one particular antibiotic that, until recently, has been very good at

treating infections such as the tropical disease visceral leishmaniasis. There have been increasing reports that the fungi causing these infections are developing resistance to the drug Amphotericin. Using ISIS, the King's College London team is trying to gain a better understanding of the antibiotic. The aim is to create a new drug that works in a similar way to the old drug, but with a chemistry that stops the disease-causing fungi developing a resistance to the drug's toxic effects.

Superconductivity and the national grid

Several groups from the University of Oxford, as well as from Germany and the USA will be looking at high-temperature superconductors. These are currently used in MRI scanners, and in the future it is hoped they will be used to significantly improve the efficiency of electricity transfer in the national grid. In particular, these experiments will look at the physics of magnetism and superconductivity in the recently discovered family of iron-based high-temperature superconductors. The importance of magnetism in these materials is very curious because magnetism normally interferes with superconductivity in the well-understood family of low-temperature superconductors. In the high-temperature superconductors, magnetism seems to be responsible for the superconductivity happening much nearer to room temperature.

Cannonballs from the War of the Roses

Evelyne Godfrey from the Open University is using ISIS to examine the manufacturing quality of two lead roundshot objects which have been recovered during an archaeological field survey at the Towton battlefield site (1461 AD). The Battle of Towton (link opens in a new window) was fought near Tadcaster in Yorkshire during the War of the Roses, and is known as the bloodiest battle ever fought before or since in England.

The objects are the earliest known examples of gunpowder ammunition from a British battlefield, and were provided for analysis by the Towton Battlefield Archaeology Project.

Major ISIS upgrades

The planned six month shutdown has seen the neutron source undergo a major maintenance programme to ensure it is operating at the highest possible level for its users. The work was carried out from August 2010 to February 2011. The shutdown was necessary to replace a wide range of ISIS equipment and components, some of which were installed 25 years ago. The whole programme has been delivered on time and to budget.

More details are available in the 'Beam on' section of the ISIS website.

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