Superconducting Technology

A major new research centre, the Centre for Applied Superconductivity has opened to develop novel superconductors, which are vital for technologies in healthcare, quantum computing and many other fields.

UNIVERSITY OF OXFORD

www.physics.ox.ac.uk/enterprise

Levitation of a magnet above a superconductor (Stephen Blundell and Andrew Boothroyd)

The phenomenon of superconductivity was first discovered in solid mercury at liquid helium temperatures over a hundred years ago. When cooled below a critical temperature, close to absolute zero, mercury exhibits a remarkable property: an electrical current passed through it shows no resistance at all. Over the last century, it has been found that a larger range of materials can also exist in this unique state of matter.

Even materials such as metals that are good conductors of electricity normally show resistance to electrical currents, which results in electrical energy being wasted as heat. But superconductors can carry current without any dissipation, and so they have enormous potential for improving electrical efficiency, especially where equipment requires large amounts of power. Superconductors are already used in applications such as MRI scanners and particle accelerators like the Large Hadron Collider. One stumbling block, however, is that most existing superconducting materials only work at extremely low temperatures. This requires the use of expensive cryogenic liquids to achieve the necessary cooling.

Oxford's new Centre for Applied Superconductivity (CfAS) aims to provide a 'joined up' approach to problems in superconductivity, linking together fundamental physics research, materials discovery and development, and industry. It is a collaborative effort between local companies and Oxford University's Departments of Physics and Materials.

The Centre has already established research projects with leading local companies in the sector, including Siemens Magnet Technology and Tokamak Energy. Superconducting circuits will also play a big role in the development of new quantum technologies. Achieving this requires a sustained effort to understand the fundamental nature of superconductivity. To do this, researchers are using high magnetic field facilities in Oxford, which enables them to look inside the superconducting state and study its electronic structure. Some newly-discovered superconductors can function at unusually high temperatures, the highest being about -70°C, however the ultimate goal is to predict and discover superconductors that work at room temperature.

"CfAS is a vital local resource that enables us to tackle such a huge challenge of global importance, it provides world-leading problem solving expertise for industry and training for new generations of technicians and scientists as well as cutting-edge research into new superconducting products and processes."

Dr David Kingham, Chief Executive of Tokamak Energy

Funded by: Oxfordshire Local Enterprise Partnership