New material could help cut future energy losses

March 19 2009

Scientists at the University of Liverpool and Durham University have developed a new material to further understanding of how superconductors could be used to transmit electricity to built-up areas and reduce global energy losses.

The team have produced a material from a football-shaped molecule, called carbon60, to demonstrate how a superconductor - an element, compound or alloy that does not oppose the steady passage of an electric current - could work at temperatures suitable for commercial use in cities and towns.

Superconductors are considered as one of the world's greatest scientific discoveries and today play an important role in medical technology. In 1911, as part of an experiment with solid mercury, Dutch scientist Heike Kamerlingh Onnes, discovered that when mercury was cooled to low temperatures, electricity could pass through it in a steady flow without meeting resistance and losing energy as heat.

Superconductors are now widely used as magnets in magnetic resonance imaging (MRI), which help scientists visualise what is happening inside the human body. They are also demonstrated in train lines as magnets to reduce the friction between the train and its tracks. Superconductors have been developed to function at high temperatures, but the structure of the material is so complex that scientists have yet to understand how they could operate at room temperature for future use in providing power to homes and companies.

Professor Matt Rosseinsky, from Liverpool's Department of Chemistry, explains: "Superconductivity is a phenomenon we are still trying to understand and particularly how it functions at high temperatures. Superconductors have a very complex atomic structure and are full of disorder. We made a material in powder form that was a non-conductor at room temperature and had a much simpler atomic structure, to allow us to control how freely electrons moved and test how we could manipulate the material to super-conduct."

Professor Kosmas Prassides, from Durham University, said: "At room pressure the electrons in the material were too far apart to super-conduct and so we 'squeezed' them together using equipment that increases the pressure inside the structure. We found that the change in the material was instantaneous - altering from a non-conductor to a superconductor. This allowed us to see the exact atomic structure at the point at which superconductivity occurred."

The research, published in *Science* and supported by the Engineering and Physical Sciences Research Council (EPSRC), will allow scientists to search for materials with the right chemical and structural ingredients to develop superconductors that will reduce future global energy losses.

Source: University of Liverpool (news : web)