Coated thread generates electricity

Clothes power up thanks to nanowires

NATURE

Researchers in the US have invented a yarn that can generate electricity simply by being bent or twisted. Clothes made from the fabric could generate enough electricity to power a mobile phone or iPod, the scientists say.

Zhong Lin Wang and colleagues at the Atlanta Institute of Technology in Georgia exploited the piezoelectric properties of zinc oxide (ZnO), which generates a small pulse of electrical energy when bent or twisted.

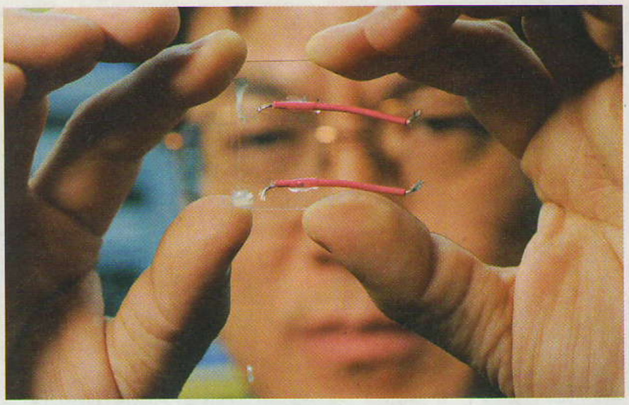
By placing a thread of the carbon fibre material Kevlar into a solution containing zinc and oxide ions, the researchers covered the Kevlar in tiny nanowires of zinc oxide, each wire growing laterally from the central carbon core so that the final structure resembled a microscopic bottle brush. The nanowires are between 100 and 200nm in diameter and a few micrometres long.

The researchers then grew a second 'bottle brush' and coated it with gold. They intertwined the two threads and showed that if the threads are moved relative to each other the friction causes the crystals to bend, generating electricity. The gold-coated thread carries away the electricity, which could be stored or used to power small electronic devices.

Wang and his colleagues made a tiny patch of fabric using six such threads to show that the system could potentially be scaled up. 'We think we could get 80 milliwatts of electrical power from a square metre of fabric,' Wang told *Chemistry World*. 'That's enough to power a cellphone or an iPod, or the power could be accumulated and stored for later use.' Clothes made from such a fibre need not be expensive, Wang added. 'The technique for growing the nanowires on the fibre is cheap and it was done by chemical synthesis at 70°C,' he said. 'More importantly, ZnO is a biocompatible and biosafe material.'

Steve Beeby, an energy-scavenging expert from the University of Southampton, UK, told *Chemistry World* that while fabricating the nanowires and showing that they generate electricity was an impressive feat, there were still practical hurdles to overcome. 'The robustness of such nanostructures for the long term generation of energy in the envisaged applications will always be a concern,' he said. 'I feel it will be some time before the predicted power output is achieved.

Simon Hadlington



Power dressing: here shown in pink

Reference
Y Qin *et al*, *Nature*, 2008, **451**, 809, DOI: 10.1038/nature.06601

Silver hexacyanocobaltate gets shorter and fatter on heating

Crystal shows colossal expansion

SCIENCE

A super-stretchy crystal could help to develop improved coatings for satellites facing the extreme temperature variations of space, according to UK scientists.

Andrew Goodwin from the University of Cambridge and colleagues from the universities of Cambridge, Oxford, Durham and the Rutherford Appleton Laboratory, investigated the behaviour of silver(I) hexacyanocobaltate(III), $Ag_3[Co(CN)_6]$, across a range of temperatures using neutron scattering and x-ray diffraction.

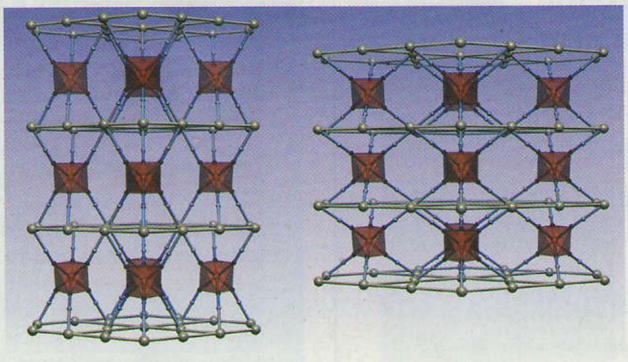
The team found that heating the crystals made them expand massively in one direction, while shrinking in the other. The effect was much greater than observed in other crystalline materials.

The key to the effect lay in the crystal's unusual lattice structure, Goodwin told *Chemistry World*. 'Within the crystal, cobalt transition metal centres are connected by long, flexible linkages, so they can move relatively easily,' he explained.

Sandwiched between these cobalt layers lie silver ions in the same plane. These ions are weakly bound together due to a phenomenon called the argentophilic effect: a loose, non-covalent interaction resulting from peculiarities of the silver ion's electron cloud. 'Ordinarily this association between the silver ions would be so weak that it would not affect the properties of a material,' Goodwin said. 'But because the bonds between the cobalt centres are so long and flexible, when the material is heated the silver ions move apart, which flexes the lattice.' This causes the crystal to extend laterally and collapse vertically.

Goodwin said his team has found other related materials that show similar properties. 'These appear to be quite general properties that should be easy to tailor,' he added. Such compounds could be used to coat optical instruments on satellites, counteracting their shape changes when they are subjected to extreme heat and cold.

Simon Hadlington



Heating the crystal squashes it as silver ions (grey) move apart

Reference
A L Goodwin *et al., Science*, 2008, **319**, 794 (DOI: 10.1126/science.1151442