Nanotube production leaps from sooty mess in test tube to ready formed chemical microsensors

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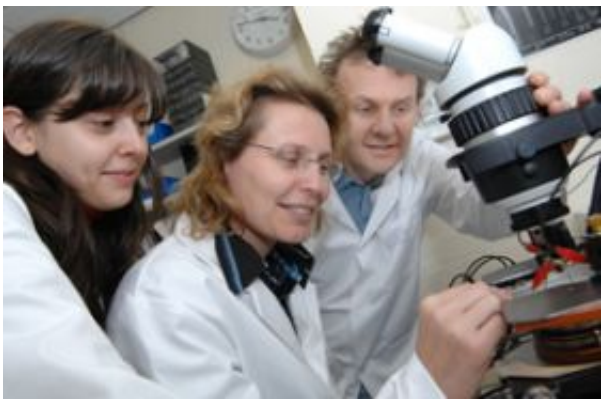

Carbon nanotubes' potential as a super material is blighted by the fact that when first made they often take the form of an unprepossessing pile of sooty black mess in the bottom of a test tube. Now researchers in the University of Warwick's Department of Chemistry have found a way of producing carbon nanotubes in which they instantly form a highly sensitive ready made electric circuit.

The research has just been published in a paper entitled "Single-Walled Carbon Nanotube Network Ultramicroelectrodes" by University of Warwick researchers Ioana Dumitrescu, Professor Julie Macpherson, Professor Patrick Unwin, and Neil Wilson in *Analytical Chemistry* (2008,

10.1021/ac702518g)

The researchers used a form of chemical vapour deposition and lithography to create the ready made disc shaped single walled carbon nanotube based ultramicroelectrodes. The nanotubes deposit themselves flat on a surface in a random but relatively even manner. They also all overlap sufficiently to create a single complete metallic micro-circuit right across the final disc. What is even more impressive is that they take up less than one per cent of the surface area of the disc.

This final property makes these instant ultramicroelecrodes particular useful for the creation of ultra sensitive sensors. The low surface area of the conducting part of the disc means that they can be used to screen out background “noise” and cope with low signal to noise ratios making them up to 1000 times more sensitive than conventional ultramicroelecrodes sensors. This property also produces very fast response times allowing them to respond ten times faster than conventional ultramicroelecrodes.

As these ready made ultramicroelecrodes are carbon based they also open up a range of new possibilities for use in living systems. The biocompatibility of carbon is in stark contrast with the obvious problems that platinum and other metal based probes can pose for living tissue. The Warwick research team are already beginning to explore how their single walled carbon nanotube based ultramicroelecrodes can be used to measure levels of neurotransmitters.

The new ultramicroelecrodes also open up interesting possibilities for catalysis in fuel cells. Up till now researchers had been aware that this form of carbon nanotubes appeared to be particularly useful in the area of catalysis but there was uncertainty as to whether it was the properties of the carbon nanotubes per se that provide this benefit or whether it was due to impurities in their production.

The researchers have been able to use this new method of single walled carbon nanotube assembly to prove that it is actually the properties of the carbon nanotubes themselves that are useful for catalysis. The new carbon nanotube assembly technique brings a further benefit to catalysis applications as the Warwick researchers have been able to use electrodepoistion to quickly and easily apply specific metal coatings to the ready formed single walled carbon nanotube microelectrode networks. This will be of significant benefit to anyone wanting to use single walled carbon nanotube for catalysis in fuel cell technology.

Source: University of Warwick