


 Search

[Home](#) > [Innovation](#) > [Innovation features](#) > Nano-technology – the next giant leap forward?

0

Innovation news

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Technology and a brighter future for our world

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Baking in Philosophy?

Innovation and 'hanging out'

Net gain for TV voting

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Nano-technology – the next giant leap forward?

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Nano-technology – the next giant leap forward?

by *Jeff Patmore, head of strategic university research, BT*

I think we are about to move forward in a technology leap which although not quite as big as the invention of the printing press, or telegraph could revolutionise how we move both electrical power and data around.

I had become aware of the impact of nanotechnology a couple of years ago when I spoke to Mark Mann, a young researcher at the University of Cambridge.

Mark had successfully used a single carbon nano-tube to increase the resolution of an electron microscope, something which had been quite remarkable because the resolution possible until then had not changed in many years.

Essentially the nano-tube concentrated the electron beam at its source by channelling the flow of electrons through the nano-tube. This was something unique.

A short while ago, at the University of Cambridge I had lunch with Krzysztof Koziol, a 'nano-scientist' who explained that the science had moved on a little since my first sight of it.

Just recently - literally in the last few months - he had discovered a way to produce a continuous 'filament' composed of metallic carbon nano-tubes aligned nose to tail.

I was both intrigued and impressed by this, but did not initially understand the true significance of the breakthrough.

This filament has some quite amazing properties.

Firstly, as Krzysztof explained, the filament conducts electrical current on the level of traditional conductors like copper or even silver. However there is further indication that the material will carry current much better than the best currently available conductor, bringing it the closest anyone has come so far to a room temperature super-conductor.

Although not as efficient as a true super-conductor it is a significant break-through.

Large capacity

I assumed that as the filament was so small, several micrometers in diameter, that the current that could be carried was quite small, but of course I was thinking in conventional terms. In fact the current capacity is exceeding 100 thousand amperes per square centimetre of this new nano-tube based conducting wire.

When I asked about the practical uses such as connecting this new invention to conventional electronic circuits he explained that his research group has already designed a silver termination for the filament which allows it to be connected to circuit boards, while maintaining the exceptional conductivity.

Secondly the filament is both very strong and very flexible. You could tie a knot in it and Certainly, it could be woven into clothing. It is also stable to around 500 degrees centigrade in air and therefore could be used in specialised clothing.

Because the electron flow is through the carbon nano-tubes, it displays some interesting electrical characteristics at radio frequencies and as a 'transmission line' is again very efficient.

By this point in our conversation I was at the 'wow' stage.

During our conversation I had explained that I was comfortable with nano-scale concepts, mainly due to my early work with single mode optical fibres, where core diameters are of the same order, which strangely led our conversation onto chatting about ways in which this new medium could be connected to optical fibre.

Fibre feasibility

He explained that some early work has been carried out to look at an 'electrical to light' interface, to examine how this new 'fibre' could be connected to a conventional optical fibre and there has already been some success in demonstrating the feasibility.

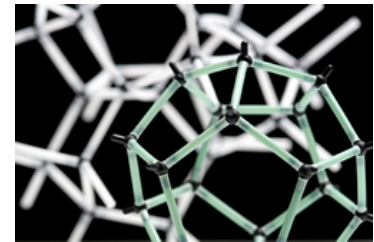
When you have spent 40 years in communications engineering, with more than ten years in communications research, there is usually very little that surprises you.

However, this really surprised me.

I have often written about the fact that we live in a world of exponential change, the time of a nice linear comfortable time progression from one discovery to the next seems to be something that just does not exist anymore. Gordon Moore and his 'law', coupled with instant global communication and collaboration have taken care of that.

I cannot be sure that the insight I received over lunch provided me with an early view of the next major change in communications, but if this is not, I would be surprised.

This is a tremendous time to be in research and to be working closely with universities. What we must do is ensure that we communicate these startling pieces of work in a way that people can understand and value, especially those things that could herald a radical change in communications technology.



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