

Flexible circuits made from 'wonder material' graphene printed from ordinary ink-jet machine

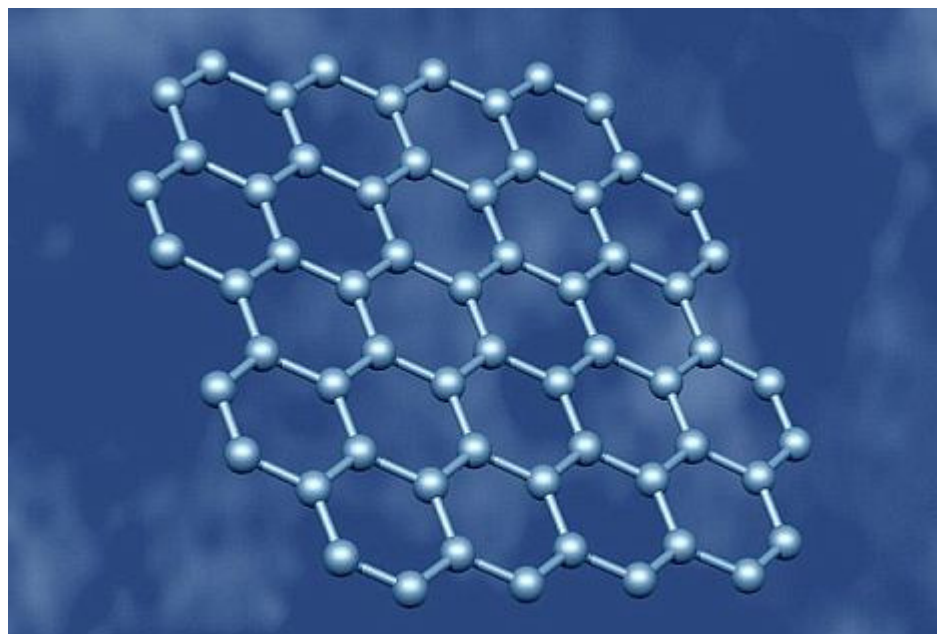
By [Ted Thornhill](#)

Last updated at 10:32 AM on 29th November 2011

'Wonder material' graphene is so tough a sheet as thin as cling film can support an elephant and there's nothing that can match its conductivity – now scientists have found a way of printing it.

The researchers, from Cambridge University, made flexible electronics from graphene using a humble home printer, bringing devices such as wearable computers a step closer.

The scientists created a graphene-based ink and used a modified Epson printer to produce the thin-film circuits.



Amazing properties: Graphene is the world's thinnest, strongest and most conductive material

Printed electronics aren't a new technology but at the moment they use metal nanoparticle inks, which oxidise after a couple of years and lack the efficiency of silicon-based circuits.

The Cambridge team – led by Andrea Ferrari – have made a giant leap forward because their printable graphene transistors are lighter, more conductive, more stable and cheaper to produce than anything seen before.

The graphene is made from ordinary graphite - the 'lead' in pencils.

The researchers took a block of it, chipped off some microscopic flakes and dissolved it in N-Methylpyrrolidone, or NMP.

This solution was then loaded into an ink cartridge and printed out.

Writing in Arxiv, Ferrari says: 'This paves the way to all-printed, flexible and transparent graphene devices on arbitrary substrates.'



Cheap and easy: The scientists printed graphene-based transistors using a simple home Epson machine like this

In other words, it makes flexible, wearable electronics genuinely viable as it's been demonstrated that multi-million-pound equipment isn't needed to produce it on a mass scale.

The discovery of graphene in 2004 by Professors Andre Geim and Kostya Novoselov at the University of Manchester won them the Nobel Prize for Physics.

Chancellor George Osborne recently announced a £50million investment for research into the material.



Inspection: Chancellor George Osborne tours the graphene labs at the University of Manchester

At the Conservative Party Conference he said: 'It's the strongest, thinnest, best conducting material known to science, to be used in everything from aircraft wings to microchips.'

'The inventors could have gone anywhere in the world to do their research. But they chose The University of Manchester.'

'We will fund a national research programme that will take this Nobel-prize winning discovery from the British laboratory to the British factory floor.'

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It will end up being exploited abroad, yes because our senseless workforce, people will have noticed yesterdays strike and think, here we go again and then the strikers will be saying, were has my job gone? I apprecaite people want good working conditions and a wage to live on, but its not a God given right, when you do get to work, you have to do something other than read the paper, pick your nose and look out the window. Look at evrything you buy, it's made in China, because people are on lower wages and do a days work. I agree, the Chinese will get bigheaded and start reading the paper and picking their noses, then there are other countries coming to the front and maybe one day it may arrive in ONCE Great Britain. Wake u idiots.

- Paul, Manchester, 30/11/2011 22:58

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At last! Something I can support my Elephant with.

- Steve, Georgia, 29/11/2011 18:51

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I supose that this will be another product invented in this country but produced in China!

- Spencer I. mather, Bradwell, UK., 29/11/2011 17:20

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Could this technology's durability and conductivity properties be exploited to produce a photo-voltaic film to apply to household or commercial windows to control heat gain and produce electricity?

- GA Lewis, Austin, TX, 29/11/2011 14:11

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My greetings to "Monkey's Uncle". Maybe it is "my type" that seeks to properly evaluate and quantify risk rather than storm in regardless and in ignorance of possible outcomes. If there is minimal risk then I would not try to stop adoption of graphene based materials in any given context. As a Chemistry graduate and teacher I am only too aware of the problems mankind has created by thoughtless and ill-prepared adoption of technology from tobacco to thalidomide, through over-use of precious antibiotics to hormonal contamination of drinking water. The list is endless - but most of the problems could have been controlled and minimised with appropriate research beforehand. I am not a "Health and Safety" nut nor a SF fanatic but I am the sort of person who ensures I stand an appropriate distance from the Monkey's Cage should the monkey try to p**s on my boots. Unfortunately if the monkey looks cute there are fools around who will walk straight up to the cage.

- twispex, cheltenham, 29/11/2011 09:57

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- twispex, cheltenham, 29/11/2011 09:53

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Quote - "I'm not against progress but I do think we should consider health and environment alongside profit and use graphene with properly informed judgement." - twispex, cheltenham, 29/11/2011 3:03..... Oh dear, another 'Elf & Safety nut. If your kind had their way we'd never be allowed to invent anything. There are risks with just about every material we use. The very tiny amounts of shattered graphene aren't likely to pose any more of a risk to human life than death rays and other sci-fi creations.

- Monkey's_uncle, Taunton, Somerset, 29/11/2011 09:05

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Another great coup for the University of Manchester. What a fantastic seat of higher learning.

- Tom, Manchester, 29/11/2011 07:07

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Would fragments of graphene edge-on be as potentially dangerous as a carbon mono-filament fibre as described in many a SF story? I am thinking about waste dust from rubbish tips being spread by wind. if inhaled could it potentially cut up and damage our lungs and internal tissues. Maybe even deliberately used as a microscopic particle anti-personnel payload in munitions? This may seem far-fetched but the dangers of asbestos fibre, silicosis, depleted uranium dust and Tetra-ethyl lead, polybiphenols and many a toxic material have only recognised long after introduction because profit has always been the priority. Surely it is pertinent to request that potential hazards are investigated before such a radical new material is used widely. We should at least have disposal methods sorted properly before the material becomes ubiquitous. I'm not against progress but I do think we should consider health and environment alongside profit and use graphene with properly informed judgement.

- twispex, cheltenham, 29/11/2011 03:03

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But will we do anything intelligent with it. Anyone trying to invent in this country and then get funding should not bother to even start. Will it's intelligence match a bunch of Labour Ministers on the make ... doubtful. Will it make the Liberals more honest ... extremely doubtful. Will it allow the Tories to find sense ... don't even bother with the question.

- Dave, Gloucester, 29/11/2011 01:17

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