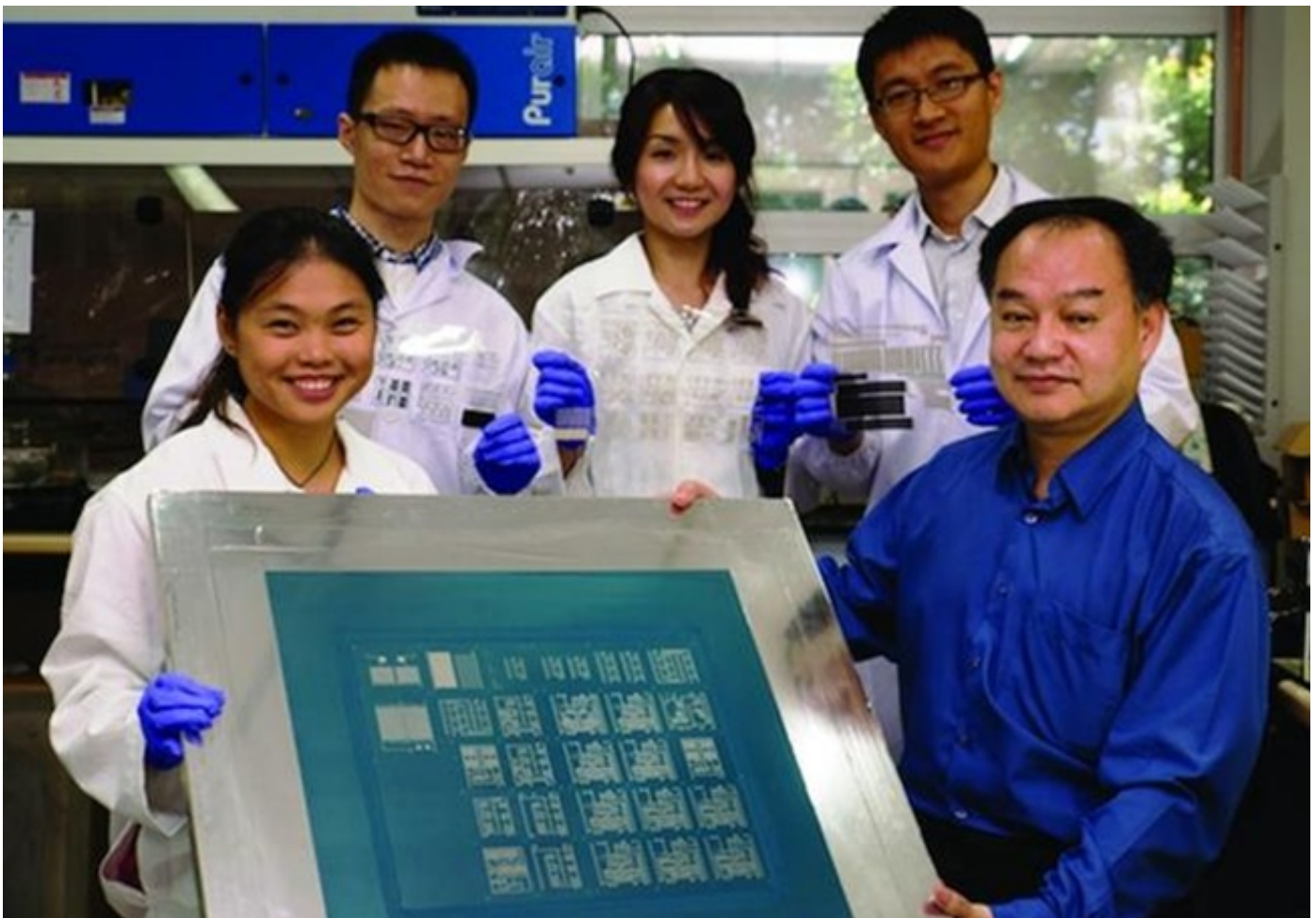


## Complex electronic circuits made with common t-shirt printer

17 November 2014



Nanyang Technological University (NTU Singapore) has successfully printed complex electronic circuits using a common t-shirt printer.

The electronic circuits are printed using unique materials in layers on top of everyday flexible materials such as plastic, aluminium foil and even paper.

Resistors, transistors and capacitors are claimed to be printed using non-toxic organic materials such as silver nanoparticles, carbon and plastics.

Associate Professor Joseph Chang, leader of the NTU Singapore research group in the School of Electrical and Electronic Engineering, said their printing technique has made mass production of cheap disposable electronic circuits possible.

'This means we can have smarter products, such as a carton that tells you exactly when the milk expires, a bandage that prompts you when it is time for a redressing, and smart patches that can monitor life signals like your heart rate,' Prof Chang said in a statement.

'We are not competing with high-end processors like those found in smartphones and electronic devices. Instead we complement them with cheaply printed circuits that cost mere cents instead of a few dollars, making disposable electronics a reality.'

The types of complex circuits the team has successfully printed include a four-bit digital-to-analogue converter – a component commonly used in turning digital signals into sound for speakers and headphones; and radio-frequency identification (RFID) tags, commonly used for tracking of goods.

According to the University, the key difference between Prof Chang's method and the other types of printed electronics is that it is fully additive and the circuits are printed entirely without the use of any toxic chemicals or oxidising agents.

'Our innovative process is green, using non-corrosive chemicals. It can be printed on demand when needed within minutes. It is also scalable, as you can print large circuits on many types of materials and most importantly, it is low cost, as print technology has been available for decades,' said Prof Chang.

The printing method pioneered by NTU Singapore has resulted in two provisional patents and research papers in several scientific publications. Of the two patents, one is on a cheap disposable Internet-of-Things for Drug Medication Adherence.

A new start-up company is being established and a venture capitalist has expressed interest to fund the commercialisation of the invention. A multinational biomedical company has also expressed interest to adopt the application of printed electronics for biomedical devices.

The four-person multi-disciplinary team – two engineers, a material scientist and a chemist – will now look at developing digital and analogue printable circuits for other biomedical applications in sensing and processing, where low-cost smart circuits are required and for smart lighting systems.

This three-year research project is funded jointly by NTU, the Agency for Science Technology and Research (A\*STAR) Science and Engineering Research Council and the Ministry of Education Singapore.

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## Readers' comments (1)

- mike blamey | 18 Nov 2014 2:45 pm

Just loved this story: not only for its 'textile' connections but for its description of 'value Engineering!' and congratulations to those involved. Didn't I read a recent story that one 'blogger' was delighted to have been described by his immediate senior as 'the laziest' Engineer in his firm', because he came up with a simple solution to a problem, that involved minimum expenditure. As a simple textile technologist, starting to learn about electronics in the 60s, I was pleased to read that the wiring harnesses are described as 'looms'( they look like our warps!) and even more when the concept of 'printed circuits' overtook such. Here we are as Engineers constantly trying to increase the value and efficiency of what we do- whilst our apparent betters (you know who you are!) constantly look backwards for precedent and for what will maximize their rewards. But we have them in our sights now!

best  
Mike B



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