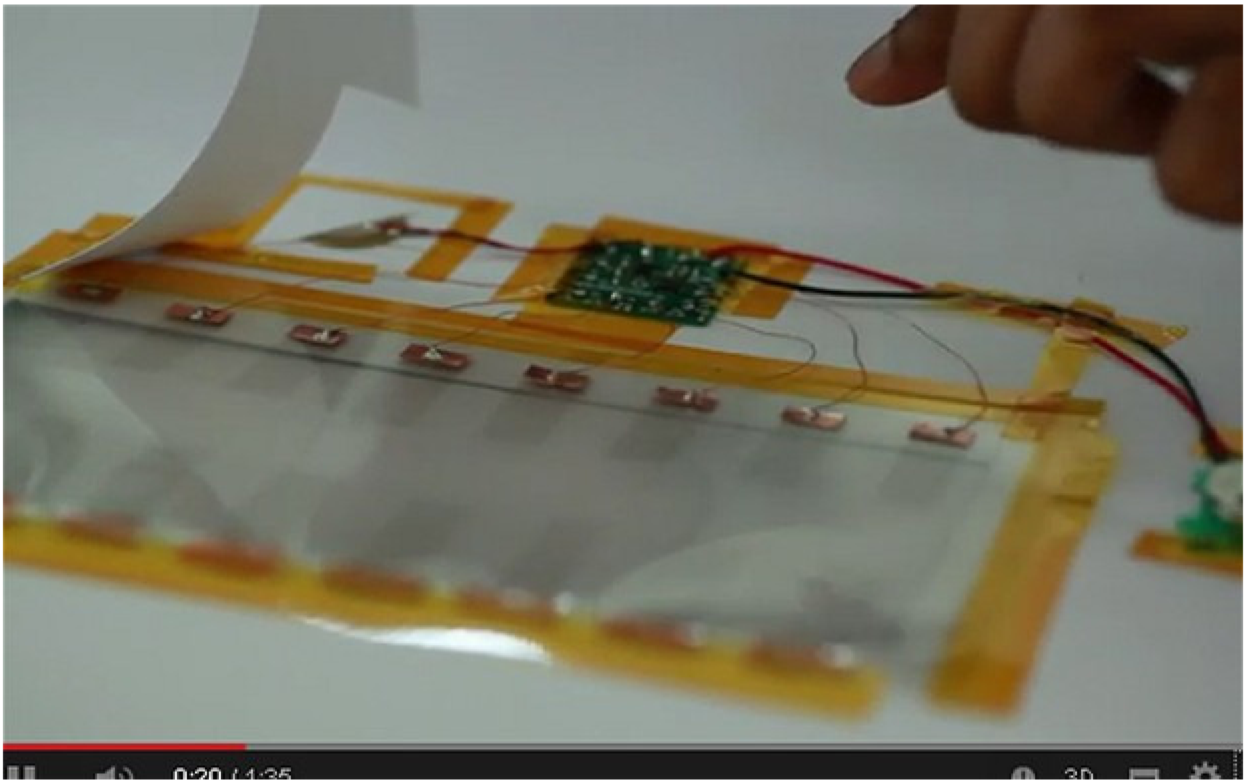
Electronic printable ink developed by scientists

A graphene-based electronic ink that paves the way for wearable, printed electronics and sensors, such as heart monitors, has been developed



A screenshot of the printed piano connected to an electronic circuit board

By Radhika Sanghani

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An electronic ink that can be printed on a laser and then conducts electricity has been developed by scientists.

The graphene-based ink was used to make a small plastic keyboard by researchers at the University of Cambridge, who found the one atom-thick material could be used to make cheap, printed electronics.

It could be used in the future for people who need heart monitors, as they could be embed onto clothes, or for tracking luggage in an airport to ensure it is loaded on to the correct plane.

The graphene-based ink has a number of interesting properties, including flexibility, optical transparency, and electrical conductivity.

Other conductive inks are made from precious metals such as silver, which makes them very expensive to produce and process, whereas graphene is both cheap, environmentally stable, and does not require much processing after printing.

Graphene ink is also superior to conductive polymers in terms of cost, stability and performance.

The piano, designed by the University's Electrical Engineering Division in collaboration with Novalia Limited, shows off the graphene ink's potential.

The keys of the transparent piano are made from graphene-based inks, which have been printed on to a plastic film.

These keys, working as electrodes, are connected to a simple electronic circuit-board, a battery and speaker.

When a person touches a graphene electrode, the amount of electrical charge held in the key changes.

This is then detected and redirected by the circuit to the speaker, creating the musical note.

The same research team, in collaboration with Printed Electronics Limited, has also developed a flexible prototype digital display which uses conventional printable materials, but with a transparent, electrically conductive graphene layer on top.

The graphene layer more conductive, flexible and transparent than the conventional polymer it replaces.

These simple displays could be used in a wide range of smart packaging applications such as toys, labelling and board games.

“Both of these devices show how graphene could be printed on to a whole range of surfaces, which makes it ideal for printed electronics,” Dr Hasan, the lead researcher behind the prototypes, said.

"For example, it might eventually be possible to print electronics on to clothing and to make wearable patches to monitor people with health conditions, such as a heart problem.”

The same team also developed an anti-fraud laser detector which ould be used to identify counterfeit banknotes, pharmaceuticals and luxury goods.

It works by exploiting an existing method for printing liquid crystal lasers with inkjet printers which gives the user a very precise level of control over the laser's pattern and colour combination.

The detector takes advantage of this by shining a second, laser pulse on to the printed one. It then reads the wavelength of the light emission from the printed laser through a dedicated software, and reproduces that reading as a pattern on a spectrograph.

The result is that each printed laser can be designed to give out its own, unique optical signature. Because lasers can be printed on to all sorts of surfaces – such as plastic, paper, metal and glass – the technique could be used to authenticate a wide range of products.

“Every year, hundreds of thousands of people are sold fake pharmaceuticals under the mistaken belief that they will help them, while counterfeit products cost companies hundreds of billions of pounds,” Dr Gardiner said. “We think that our printed lasers could be used to protect both products and people."