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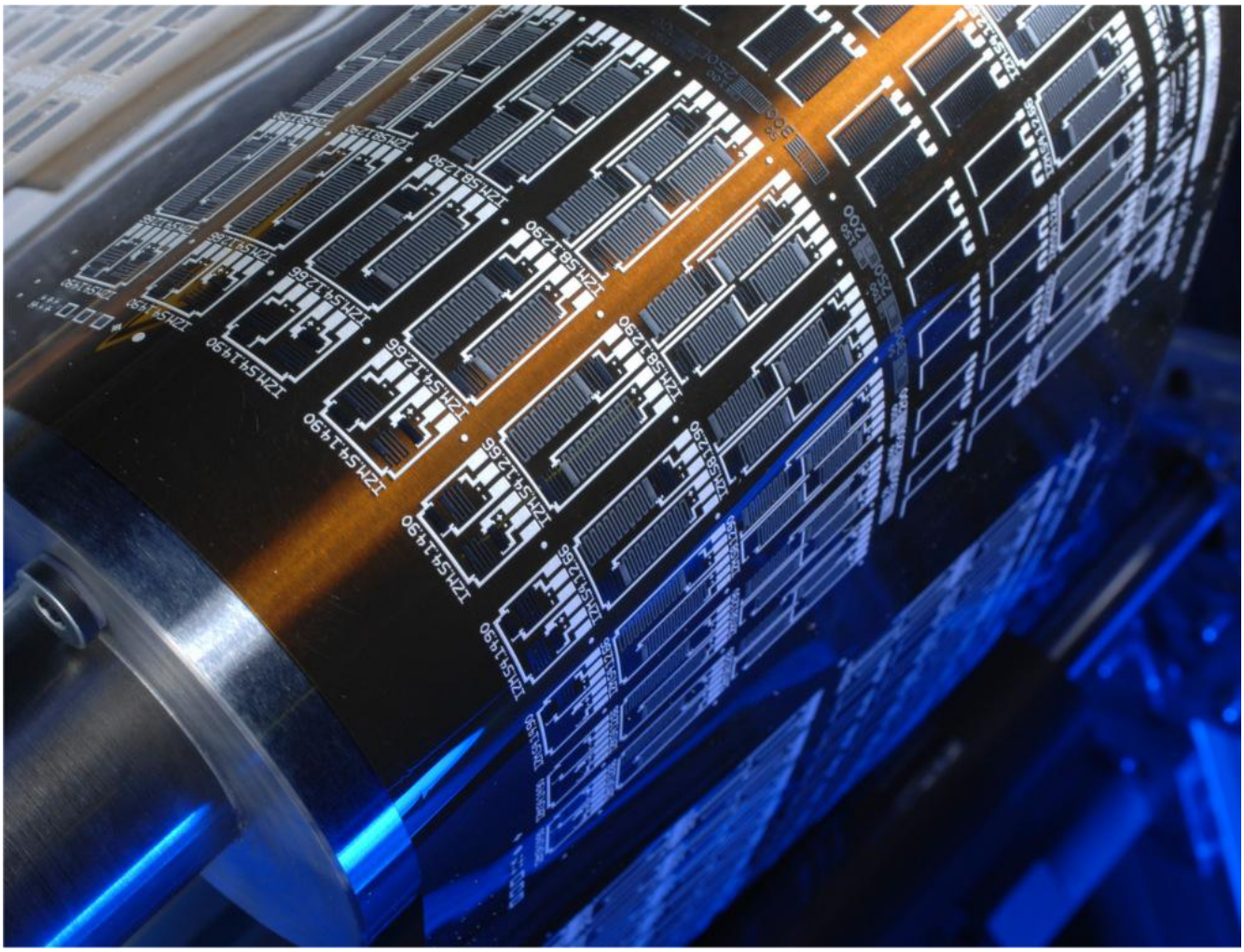

Organic circuits - lighter, cheaper and bendier

A new type of plastic electronics made from organic materials is lighter, cheaper, and more flexible than any of today's technology. Such circuits could be worn on clothing or placed inside medical sensors.

17 March 2014 - By JON CARTWRIGHT

Electronic components such as transistors form the backbone of all modern computers, whether they are laptops, tablets, or smartphones. Today they are almost exclusively made from silicon, a widely available semiconductor.

But silicon has its drawbacks: it is opaque, almost always rigid, and has to be manufactured in individual sheets. If electronics could instead be made from organic materials – those such as plastic that contain chains

of carbon atoms – it could be transparent, physically flexible, and fabricated continuously on a roll.

Organic electronics could be used to make ‘smart skins’ that seamlessly integrate with bendy surfaces, or even be used inside the human body, according to Professor Karlheinz Bock, director of the Fraunhofer Research Institution for Modular Solid State Technologies EMFT in Germany.

‘They can be bio-compatible with organic environments, and could therefore be used for medical sensing, wearable electronics, implantable devices and more,’ he said.

Prof. Bock works on the EU-funded project COSMIC, which explores the potential of organic electronics. The project is developing organic technology to see whether it can be brought into the mainstream electronics industry.

One of the other advantages of organic electronics is that they can work at a much lower power supply – often below 10 volts – reducing power consumption and meaning they would not disrupt existing electronic devices if they were connected to them.

Last year, the COSMIC project demonstrated the first fabrication of a complementary organic analogue-to-digital converter – an electronic component that is used, for instance, in temperature sensors. A silent authentication tag is also being built to show the potential of organic electronics in the security tracking of goods. The project is also working on making flexible batteries for use with bendy devices.

Other EU-funded projects are trying to improve organic fabrication methods – for instance POLARIC, which is coordinated by the VTT Technical Research Centre of Finland. POLARIC scientists are hoping to make the fabrication faster, make the components smaller, and make the testing more rigorous – all to make organic electronics more attractive to the trillion dollar global semiconductor industry.

Image par microscopie confocale montrant des cellules humaines infectées par la grippe. Représentation tridimensio
Image par microscopie confocale montrant des cellules humaines infectées par la grippe. Représentation tridimensionnelle en isosurface réalisée au Centre Commun de Quantimétrie, UCBL1, Lyon. © Inserm/Rosa-Calatrava, Manuel & Ressnikoff, Denis

The world's first functional 8-bit organic microprocessor featuring some 4 000 organic thin-film transistors processed directly (i.e. without transfer) onto flexible plastic foil. ©IMEC

Flexible solar chargers

The HiFlex Project is investigating another highly desirable application of organic materials: flexible solar chargers which can be integrated into small electronic products such as mobile phones.

The HiFlex flexible organic photovoltaic module for chargers has a key advantage over similar modules in that it does not require the use of indium tin oxide (ITO) as a conductive layer. ITO is very expensive, and may be in short supply in the future.

The production process of small-sized modules in the HiFlex project also does away with the use of silver, further reducing costs and making the project more viable in the long-term.

Another EU-funded project, MOMA, is turning organic electronics into computer memory – specifically a flexible alternative to flash, a quick form of data storage used in tablets, smartphones, and increasingly laptops. Flash is made from arrays of transistors which can be switched on or off to represent the numerous ones and zeros of binary information.

Today’s flash memory has a very high capacity – often hundreds of gigabytes. But according to project coordinator Dr Gerwin Gelinck at the Netherlands Organisation for Applied Scientific Research, many of the proposed applications of organic electronics – implantable devices, for instance – need to store less than a kilobit of data.

At the end of 2012, MOMA scientists demonstrated the largest flexible alternative to flash to date – an array of over one thousand organic transistors. They believe that one of the first uses of their technology will be

flexible security tags, which could be applied discreetly to expensive fashion garments.

More info

COSMIC

POLARIC

MOMA

HiFlex