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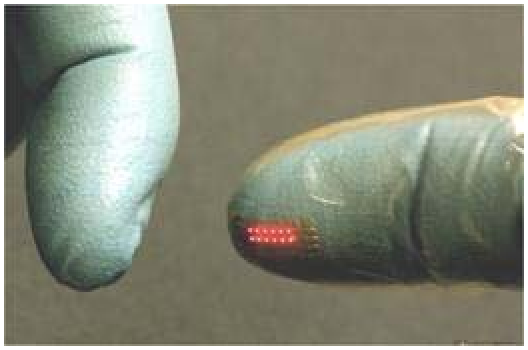
News

Flexible LEDs to boost biomedicine

Bendy, waterproof electronics made with conventional semiconductors could be implanted in the body.

Jon Cartwright

Bendy, stretchy and bio-compatible arrays of light-emitting diodes (LEDs) and photodetectors that can be implanted under the skin are boosting prospects of using light inside the body to activate drugs or monitor medical conditions.



An array of LEDs printed onto a vinyl glove, to create a light-emitting fingertip.
J. Rogers Univ. of Illinois

The materials were made by John Rogers at the University of Illinois at Urbana-Champaign and his colleagues, who describe applications of their work today in *Nature Materials*[1].

A number of research groups are pursuing ways to make bendy and stretchy electronic circuits, including those containing LEDs. But most of these efforts rely on new materials, such as carbon nanotubes combined with silicon; or suspensions of conductive nanoparticles printed directly onto cloth. So far, none of these is close to commercial application.

By contrast, Rogers' group uses the established semiconductor gallium arsenide (GaAs) and conventional metals for diodes and detectors. Although these materials are very brittle, Rogers and his co-workers last year described a way to create flexible electronic circuits from them — by stamping thin GaAs-based components onto a plastic film[2].

In the latest advance, Rogers *et al.* show that, by depositing coiled interconnecting metal wires onto the plastic, they can create a mesh-like array of LEDs and photodetectors that can withstand extreme mechanical deformation. The mesh is then bonded to a pre-stretched sheet of rubber which is encapsulated in a bio-compatible transparent piece of rubber.

The resulting circuit can be bent, twisted and stretched in any direction. Tests have shown that the behaviour of the LEDs and photodetectors remains unchanged even after the circuit is repeatedly stretched by 75%. Yet the flexibility has little to do with the devices themselves: it is mainly down to the interconnecting wires, whose coiled-up state accommodates a huge amount of expansion.

Paul Calvert, a materials engineer at the University of Massachusetts in Dartmouth who has studied the applications of electronics on textiles, says that there is little new science in the rubber circuits. But he notes that they might find relevance in, for example, the medical testing of blood oxygen levels, by measuring a transmitted light spectrum within the body. "The demonstrations are impressive and they will set a lot of people wondering about using something similar for particular applications," he adds.

Rogers says that he and his colleagues are developing medical devices for use *in vivo* through their start-up company mc10 in Cambridge, Massachusetts. They think that versions of their rubber circuits could be used to administer light-activated drugs, and possibly also in the nascent field of phototherapy, which attempts to hasten the healing of wounds with lasers.

Brian Derby, a materials scientist at the University of Manchester, UK, agrees that the development is less a scientific breakthrough than a feat of engineering. However, he has spotted a drawback: the use of interconnecting wires to take the mechanical strain keeps the device density low. "The large spacing of the LEDs or photo-detectors will lead to a limited range of applications — no flexible displays, for example," he says.

References

1. Kim, R.-H. *et al. Nature Mater.* doi:10.1038/NMAT2879 (2010).
2. Park, S.-I. *et al. Science* **325**, 977-981 (2009). | Article | PubMed | OpenURL | | ChemPort |

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#15085

What is funny is that this will be first developed into "body-modification" consumables. A glow in the dark tatto? Coooool.
Kidding aside, this could happen pretty fast.

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