

Micro-LED Devices Flex for Biomedical Applications

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A new method for combining tiny LEDs with flexible substrates could lead to a host of biomedical applications, from balloon catheters to photoactivated drug delivery, according to a team based at the University of Illinois at Urbana-Champaign (U.S.A.).

According to an article in *Nature Materials* (doi: 10.1038/nmat2879), the researchers first assembled arrays of small red LEDs—with lateral dimensions of roughly 25 Å—25 μm—on a rigid, multilayer temporary substrate. After the top layer is dissolved, the diodes and their serpentine-shaped gold interconnects are transferred onto a thin, pre-stretched silicone elastomer membrane.

John A. Rogers, an Illinois engineering professor and leader of the materials research group, says the design combines the best features of semiconductor LEDs (high brightness, mature technology and long life) and organic LEDs or OLEDs (thinness and flexibility).

The scientists tested the durability of the micro-LED arrays by stretching and twisting them. They bent them around a sharp pencil tip and repeatedly immersed them in soapy water. They attached them to other flexible objects—cloth scraps, aluminum foil, even a tree leaf—and demonstrated that the LEDs would still light up despite all the bending and folding.

Within the human body, these devices could be used to measure blood oxygen or glucose levels. They may also play a role in the emerging field of photoactivated drugs, which are medicines that “switch on” only in the presence of light. A small light array implanted around a tumor could stimulate anti-cancer treatments without harming other tissue. Some recent studies also suggest that certain wavelengths may accelerate wound healing.

The team used a silicone substrate that the U.S. Food and Drug Administration has already approved for medical devices. Rogers' group will expand its research into other LED colors. Practical devices are still 5 to 10 years away.

Rogers worked with collaborators at Northwestern University (U.S.A.), Korea Advanced Institute of Science and Technology, Dalian University of Technology (China), the Institute of High Performance Computing (Singapore), and Tufts University (U.S.A.).



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