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Microelectronics

Inorganic Lighting Circuitry

New fabrication method paves the way to unconventional displays

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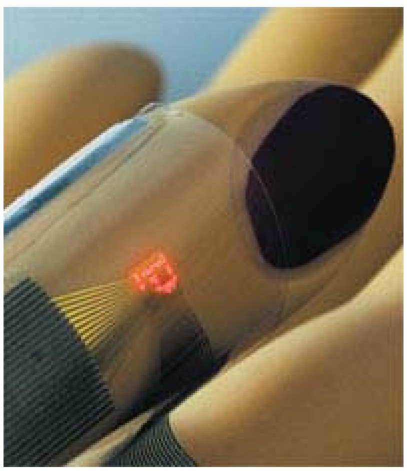
John Rogers/U Illinois

Arrays of inorganic LEDs can be fashioned on flexible materials, such as this sheet of plastic wrapped around the finger of a human-sized mannequin.

A new fabrication method can be used to assemble, process, and interconnect microscale inorganic light-emitting diodes (LEDs) to form novel types of displays and lighting systems that combine advantageous features of organic and inorganic LEDs. The new methodology may lead to improvements in resolution and other features of consumer electronics. The procedure may also bring about flexible devices, such as wearable health monitors.

Numerous features of organic LEDs, such as their high power efficiencies and capacity to generate brilliant colors, have made these circuit elements key components in a large fraction of everyday electronic gadgets. Organic LEDs are also attractive because they can be formed on flexible substrates in dense, interconnected arrays. Inorganic LEDs can be brighter, more robust, and longer lived than their organic counterparts. Yet until now, inorganic LEDs have been limited to relatively low-resolution applications because they could not be fabricated in sufficiently small size or high-pixel-count arrays.

Those limitations may now be a thing of the past as a result of new procedures for making ultrathin and ultrasmall inorganic LEDs (*Science* **2009,** *325,* 977). The techniques were developed by a large team of researchers that includes Sang-Il Park, Yujie Xiong, and John A. Rogers of the University of Illinois, Urbana-Champaign.

In the new procedure, arrays of precursors to LEDs are grown epitaxially from layers of AlInGaP that are deposited on an AlAs layer, which in turn sits on a GaAs wafer. After etching with acid to remove the AlAs, the team uses stamp printing to deposit large numbers of LEDs simultaneously onto stiff, flexible, and stretchable substrates. Through repeated stamping, the group can fashion large and unconventional LED patterns. That approach, combined with thin-film methods for forming interconnects, differs from conventional robotic “pick and place” and bulk wiring methods typically used for positioning and addressing inorganic LEDs.

Ali Javey, professor of electrical engineering at the University of California, Berkeley, remarks that “this is beautiful work, which could have important implications for flexible and deformable displays.”

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