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TODAY'S HEADLINES

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ORGANIC ELECTRONICS

TOWARD BETTER, COLORFUL DEVICES

Scientists report advances in making organic transistors and green polymer

BETHANY HALFORD

Two new reports in the hot field of organic electronics highlight advances in the fabrication of flexible transistors and colorful displays.

A group led by John A. Rogers, a materials science professor at the University of Illinois, Urbana-Champaign, and Michael E. Gershenson, a physics professor at Rutgers University, has made single-crystal organic transistors using an unusual fabrication method that may allow them to gain a deeper understanding into the basic operation of these devices [*Science*, **303,** 1644 (2004)].

Organic transistors usually are built by depositing components such as electrodes and dielectrics onto an organic material. The fabrication process, though, often damages the organic material's fragile surface. The team, which also includes scientists from Lucent Technologies' Bell Laboratories, circumvents this difficulty by placing the components on a silicone rubber support and then covering the support with the organic material--a high-quality rubrene crystal.

This "lamination" process can be carried out under ambient conditions and requires no pressure or adhesives. The rubrene crystal makes intimate contact with the support through van der Waals interactions. Micrographs show that the process introduces no bubbles or defects between the crystal and the support. Rogers says that, to the best of his ability to measure it, the fabrication process is completely nondestructive.

The lamination also is reversible. The organic crystal can be peeled off, reoriented, and relaminated repeatedly without damaging it. Repositioning the crystal allows the group to study

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what effects crystal orientation have on the device's performance.

Remarkably, the single-crystal rubrene transistors exhibit extremely high charge-carrier mobilities--about 10 times greater than those of the best thin-film polycrystalline transistors. The researchers suspect that the phenomenon arises from the unique packing of the molecules in the rubrene crystal.

Rogers says the group is exploring ways to use the fabrication method in manufacturing.

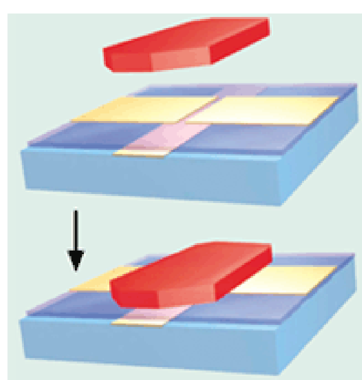
The team members hope that the information they've gleaned will lead to improvements in organic electronics that drive devices such as flexible displays.

Bringing a little color to flexible displays and other polymeric electrochromic devices, scientists at the University of California, Los Angeles, have made the first neutral, green conducting polymer [*Angew. Chem. Int. Ed.*, **43,** 1498 (2004)]. Previous green polymers were less than optimal. The new green polymer completes the red-green-blue palette that, when mixed together in varying proportions, leads to thousands of colors.

Red and blue conducting polymers have been made before. But making a green polymer proved to be a challenge because it had to absorb light at two different wavelengths, according to the report's lead author, Gursel Sonmez.

Sonmez and colleagues worked under the guidance of organic chemistry professor Fred Wudl to make a polymer out of two different conjugated systems, each absorbing at one of the two wavelengths needed to make the polymer appear green. The polymer is extremely stable and switches quickly between a deep green hue and a transparent state, depending upon the voltage applied.

The group says that "clever engineering" is all that's needed now to take full advantage of polymeric electrochromic devices.



PALETTE New green conducting polymer is shown side by side with red

LAMINATE Simple method for making organic transistors involves placing a

and blue polymers. At –0.80 V, the colors are saturated; at about +1 V, they appear transparent.	**flexible organic crystal (red) on top of an electrode-covered support.**

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