

A flexible approach to flexible electronics

Circuits that are thin, lightweight, and bendable hold promise for a wide variety of applications, particularly artificial skin, implantable sensors, and other biomedical devices. Giovanni Salvatore and colleagues in the Wearable Computing Group at ETH Zürich have now demonstrated an extremely versatile technique for fabricating flexible circuits. Starting with an ordinary wafer, the researchers deposit a thin, sacrificial polymer layer that can be easily dissolved. Next they add an insoluble thin film that will serve as the ultimate substrate for the final deposition step—the electronic circuitry. Dissolving the bottom polymer film frees the circuit-topped insoluble film, at which point it can be transferred to its intended destination.

This photo highlights one appeal of the technique: extreme flexibility and conformability. These thin-film transistors lie on a 1- μm film of the biocompatible polymer parylene that's been draped across human hairs about 100 μm in diameter. Despite the film's strong curvature, the transistor behavior is unaffected. Furthermore, the choice of film materials allows for significant customization. The insoluble film could be elastic or prestrained (see *PHYSICS TODAY*, May 2008, page 84), and the circuit electrodes could be transparent or opaque. Additional intermediate polymer layers can optionally be added to the stack to improve adhesion; the researchers successfully transferred the electronics to plant leaves, human skin, and a contact lens. (G. A. Salvatore et al., *Nat. Commun.* **5**, 2982, 2014.)

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