Scientists Make Flexible, Polymer-Based Data Storage

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The future of the electronics industry is believed by many to lie in organic materials – polymers that conduct electricity. Because they are ultra lightweight, flexible, and low-cost, they may lead to a whole new class of electronic technologies. As part of this movement, scientists recently developed a polymer-based, flexible type of data storage that displays promising information-storing characteristics.

The tiny memory device, created by scientists from the National University of Singapore and described in detail in the August issue of *Organic Electronics*, has a three-layer structure.

The middle layer, which stores the information, is a 50-nanometer-thick "copolymer," a type of polymer made of two chemically different repeating molecule chains, rather than a single repeating chain. It is sandwiched between a 40-micrometer-thick conducting polymer substrate (the bottom electrode) and a 0.2-micrometer-thick layer of gold (the top electrode).

The device's flexibility comes from its polymer substrate. Conducting polymers and other organic materials are often deposited onto rigid silicon wafers during the fabrication of memory devices and other electronics, but – although the printing methods used in these cases can be a convenient way of depositing a polymer onto a substrate – this practice physically limits the resulting devices.

Unlike conventional silicon-based memory, which stores bits of

information in tiny cells – recording a “0” for a fully charged cell and “1” for an uncharged cell, or vice versa – this device uses the polymer's conductive response to an applied voltage.

From 0 to 4 volts, the resulting current through the middle polymer layer is very low. Above 4 volts, the current abruptly increases 100-fold. The low conductivity state is considered the “off” or “0” state and the high conductivity state is equivalent to “on” or “1.” This is how the device stores a single bit of information.

The device remains in the “on” position when a negative voltage is applied across it and after power is turned off. Therefore, once information is written, it can be read many times. The device also demonstrates good thermal stability, showing signs of degradation only above 310 degrees Celsius (590 degrees Fahrenheit).

The device's on-off current ratio, one parameter that indicates the quality of a memory device, is about 200, which is comparable to certain contemporary memory schemes.

The researchers say that they expect this flexible polymer memory structure has the potential to meet the demands of a new generation of memory devices with unique shapes and architectures.

Citation: Liang Li, Qi-Dan Ling, Siew-Lay Lim, Yoke-Ping Tan, Chunxiang Zhu, Daniel Siu Hhung Chan, En-Tang Kang, Koon-Gee Neoh, “A flexible polymer memory device” *Organic Electronics* 8 (2007) 401–406