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Emerging Technology Trends

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The next silicon wave?

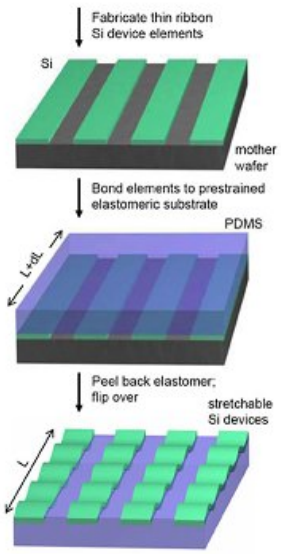
Posted by **Roland Piquepaille** @ 9:36 am

Researchers at the University of Illinois at Urbana-Champaign (UIUC) have developed **a new form of stretchable silicon** with wave-like geometries. This 'wavy' silicon could be used to build bendable electronic devices on rubber substrates. Today, the researchers have built wavy diodes and transistors which perform as well as their rigid counterparts. But other applications envisioned by the researchers include sensors for integration into artificial muscles or biological tissues and conformable skins for integrated robotic sensors.

First, how did these researchers create this bendable and stretchable silicon?

> To create their stretchable silicon, the researchers begin by fabricating devices in the geometry of ultrathin ribbons on a silicon wafer using procedures similar to those used in conventional electronics. Then they use specialized etching techniques to undercut the devices. The resulting ribbons of silicon are about 100 nanometers thick — 1,000 times smaller than the diameter of a human hair.
>
> In the next step, a flat rubber substrate is stretched and placed on top of the ribbons. Peeling the rubber away lifts the ribbons off the wafer and leaves them adhered to the rubber surface. Releasing the stress in the rubber causes the silicon ribbons and the rubber to buckle into a series of well-defined waves that resemble an accordion.

Below is a schematic illustration of the process for building stretchable single crystal silicon devices on rubber substrates (Credit: UIUC). And here is a link to **a larger version** of this picture.



But will bendable silicon devices be efficient?

> As a proof of concept, the researchers fabricated wavy diodes and transistors and compared their

> performance with traditional devices. Not only did the wavy devices perform as well as the rigid devices, they could be repeatedly stretched and compressed without damage, and without significantly altering their electrical properties.

Here is a short quote from **John Rogers**, a professor of materials science and engineering at UIUC, who worked on this project with **his group**.

> "These stretchable silicon diodes and transistors represent only two of the many classes of wavy electronic devices that can be formed," Rogers said. "In addition to individual devices, complete circuit sheets can also be structured into wavy geometries to enable stretchability."

The research work has been published online by 'Science' as an advanced publication on December 15, 2005, under the title "A Stretchable Form of Single-Crystal Silicon for Electronics on Elastomeric Substrates." Here is a link to **the abstract**.

Sources: University of Illinois at Urbana-Champaign news release, via EurekAlert!, December 15, 2005; and various web sites

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