New flexible electronics technology may lead to new medical uses

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A Wayne State University researcher has developed technology that opens new possibilities for health care and medical applications of electronic devices.

Yong Xu, associate professor of electrical and computer engineering in the College of Engineering, has developed a simple technology compatible with silicon-on-insulator (SOI) complementary-metal-oxide-semiconductor (CMOS) processes for making flexible electronics. "A Silicon-On-Insulator Complementary-Metal-Oxide-Semiconductor Compatible Flexible Electronics Technology," published recently in *Applied Physics Letters*, describes the project, which was part of a National Science Foundation effort.

Flexible electronics have attracted a lot of attention for their enormous potential in many important applications, such as wearable health monitoring devices and medical implants. While a number of approaches to making flexible sensors or electronics have been developed over the last two decades, Xu said those technologies cannot take full advantage of mainstream CMOS processes.

Xu's technology has an advantage over existing methods, such as direct fabrication on flexible substrate and transfer printing, in that it is SOI-CMOS compatible. It fabricates high-performance and high-density CMOS circuits onto SOI wafers, and then uses two layers of Parylene C (a polymer), one of which is perforated, to bond them to flexible substrates.

The lamination of the electronics between those parylene layers offers the additional benefit of protection from environmental moisture. Xu said Parylene C, which creates a flexible skin, already has been used in other medical applications and is well tolerated by human tissue.

His process allows more high-performance electronic devices to be attached to the flexible surface by eliminating the transfer printing step, in which electronics are removed from a harder surface and integrated into a softer one. Additionally, the process allows various sensors and microfluidic devices to be integrated into the flexible substrate.

Xu said his technology could result in retinal prostheses that cause less tissue irritation and therefore work better and longer, as well as more comfortable wearable health monitoring devices. Other possible applications include balloon catheters and stents.

"The ultimate goal is to develop flexible and stretchable systems integrated with electronics, sensors, microfluidics, and power sources, which will have a profound impact on personalized medicine, telemedicine and health care delivery," Xu said.

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