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Biodegradable Material Featuring Embedded Silicon-on-Silk

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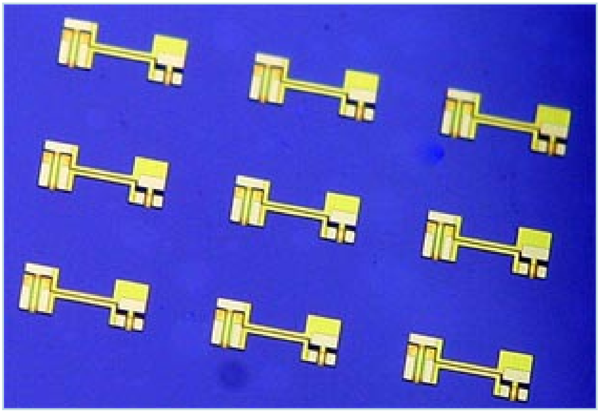
Scientists from University of Illinois at Urbana-Champaign and Tufts University have developed an approach of integrating single crystalline silicon electronics, made out of nanomembranes, into silk that is both biocompatible and absorbable by the body. This can lead to the introduction of monitors and therapeutic devices into spaces where traditional electronics cannot function safely.



The small size of the thin silicon circuits avoids adverse biological reactions while the silk conforms to tissue and dissolves harmlessly over time, factors that make the technology ideal for safely integrating biomedical devices into the human body.

Monitors are not the only potential integrative application. The technology could be used to create electrodes for brain-machine interfaces such as prostheses.

The researchers report that the paper outlines strategies for “integrating single crystalline silicon electronics, where the silicon is in the form of nanomembranes, onto water soluble and biocompatible silk substrates,” they add. “Electrical, bending, water dissolution, and animal toxicity studies suggest that this approach might provide many opportunities for future biomedical devices and clinical applications."

The challenge for these types of devices is achieving biocompatibility due to the complexity of the body's responses to many organic and inorganic materials. By avoiding the use of rigid silicon electronics or packaging materials that may not be biocompatible, silicon-on-silk electronics open up development of entirely new types of biomedical applications.

The researchers conclude that silk is preferable to other biodegradable polymers such as polyglycolic acid or collagen, because of "its robust mechanical properties, the ability to tailor the dissolution, and/or biodegradation rates from hours to years, the formation of noninflammatory amino acid degradation products, and the option to prepare the materials at ambient conditions to preserve sensitive electronic functions.

"This approach has the advantage that it does not require the development of an entire set of biogradable electronic materials, but still yields an overall system that dissipates bulk material features at a rate suitable for the application."

Full story: Is silk the secret to better biomonitors?

Abstract in *Applied Physics Letters*: Silicon electronics on silk as a path to bioresorbable, implantable devices

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