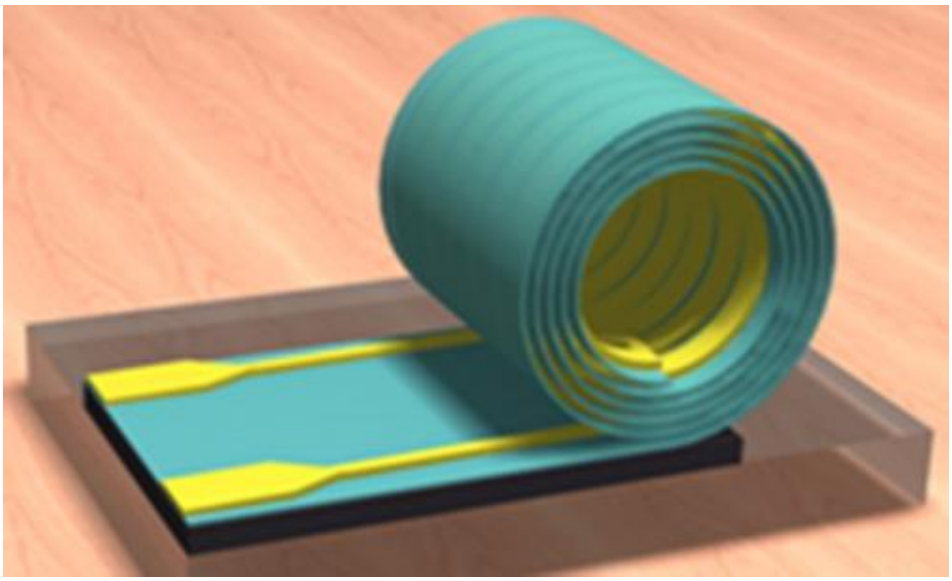
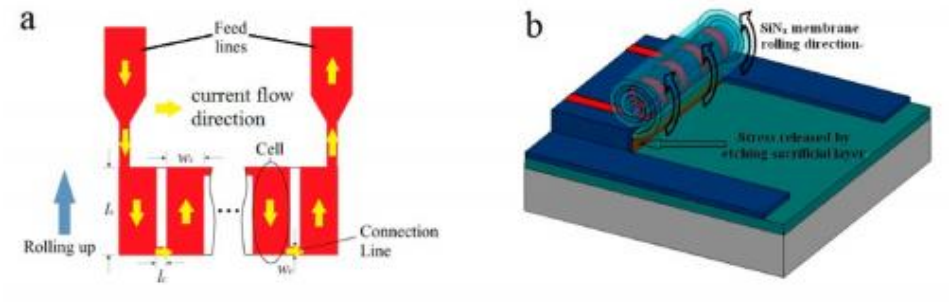
# Self-rolled tubes make miniature electronics

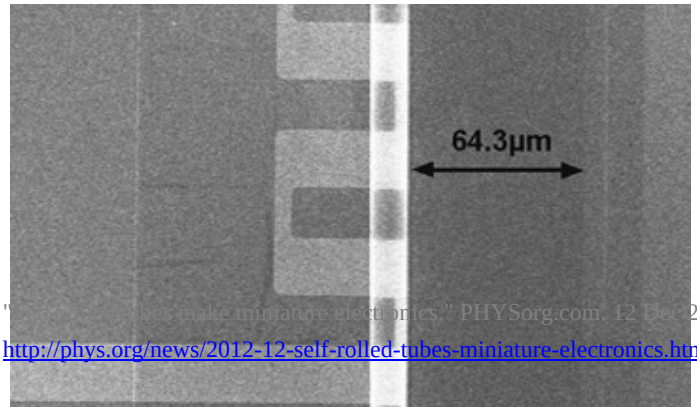


Scientists have designed a 3D inductor that rolls up from a 2D nanomembrane. The inductor offers a better performance and smaller footprint than conventional inductors. Image credit: Wen Huang, et al. Â©2012 American Chemical Society

**(Phys.org)—With downscaling as one of the main pursuits in electronics research today, scientists and engineers are developing a variety of miniaturization strategies, from those involving powerful microscopes to self-assembly methods. In a new study, a team of engineers has developed a way to miniaturize spiral inductors that are often used in radio frequency integrated circuits (RFICs) by patterning inductor cells onto a flat, strained nanomembrane that rolls itself up into a tube. In the proposed design, miniature inductors could be less than 1% of the size of conventional inductors while offering an improved performance.**




(a) A pattern of conduction strips on a 2D nanomembrane, with arrows indicating the direction of current flow. (b) A nanomembrane rolls up due to stress release. Image credit: Wen Huang, et al. Â©2012 American Chemical Society




These are experimental images of a self-rolled inductor, printed on a very thin film of silicon nitrate. Credit: Xiuling LI

"Self-rolled tubes make miniature electronics." PHYSorg.com. 12 Dec 2012.
http://phys.org/news/2012-12-self-rolled-tubes-miniature-electronics.html

These are experimental images of a self-rolled inductor, printed on a very thin film of silicon nitrate. Credit: Xiuling Li

The engineers, led by Xiuling Li, Associate Professor in the Department of Electrical and Computer Engineering at the University of Illinois in Urbana, Illinois, have published their paper on a design and prototype of self-rolled inductors in a recent issue of *Nano Letters*.

"Self-rolled-up nanotechnology is a platform my research group has been working on for several years," Li told *Phys.org*. "We have made significant progress in several aspects of the rolling-up process control and mechanism understanding, and have been looking for killer applications. I think we might have just found one. Preliminary experimental results are consistent with the simulations."

Inductors, which are devices that store energy in their magnetic fields, are commonly used in RFICs. As Li explained, RFICs are used for both wireless and wired communication applications, from portable consumer electronics to battleground surveillance. While other components of RFICs have been steadily shrinking, inductors have not been able to scale down without suffering performance losses.

"Shrinking the size without compromising or even enhancing the performance is always desired," Li said. "Compared to the aggressive scaling of active devices (transistors), inductors have simply not been able to keep up with the pace."

On an RFIC, a typical spiral inductor takes up an area of about 400 x 400

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